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A

# TREATISE

ON

## GUNTER'S SCALE, AND THE SLIDING RULE:

TOGETHER WITH A

## DESCRIPTION AND USE,

OF THE

## SECTOR, PROTRACTOR, PLAIN SCALE, AND LINE OF CHORDS;

OR

AN EASY METHOD OF FINDING THE AREA OF SUPERFICES; AND OF MEASURING BOARDS; AND OF FINDING THE SOLID CONTENTS OF BODIES, ESPECIALLY THAT OF TIMBER, BY THE SLIDING RULE; AND ALSO OF GUAGING CASKS, AND ROUND TIMBER.

TO THESE ARE ADDED SEVERAL USEFUL LOGARITHMIC TABLES, TABLES OF LATITUDE AND DEPARTURE, AND A TABLE OF NATURAL RADII, NOT KNOWN TO HAVE BEEN HERETOFORE PUBLISHED: ALSO A TABLE OF ROUND, AND SQUARE TIMBER.

BY GEORGE CURTIS, MATH.

WHITEHALL, N. Y.
PRINTED AND PUBLISHED BY E. ADAMS.
1824.

*District of Vermont,—To Wit.*

BE IT REMEMBERED, That on the twenty-seventh day of May in the forty-eighth year of the Independence of the United States of America, GEORGE CURTIS of the said district, hath deposited in this office the title of a book, the right whereof he claims as author, in the words following, to wit: "A treatise on Gunter's Scale, and the Sliding Rule, together, with a description and use of the Sector, the Protractor, Plain Scale, and Line of Chords; or an easy method of finding the area of superfices, and of measuring Boards and finding the solid contents of bodies, especially that of timber, by the Sliding Rule, and also of gauging Casks and Round Timber. To these are added several useful Logarithmick Tables, Tables of Latitude and Departure, and a table of Natural Radii, not known to be heretofore published. By GEORGE CURTIS, Math." In conformity to the Act of Congress of the United States, entitled "an act for the encouragment of learning, by securing the copies of maps, charts, and books to the authors and proprietors of such copies, during the times therein mentioned."

JESSE GOVE,
*Clerk of the District of Vermont.*

A true Copy of Record, examined and sealed by
J. GOVE, *Clerk.*

# PREFACE.

The primary design of this Treatise, is to introduce a more general attention to, and knowledge of the instruments herein described. Notwithstanding the many books that are daily issuing from the press, on other subjects, yet I have known of none that can preclude the benefits of a work of this kind. The author was led into these views by journeying through many parts of the United States, and finding a work on the subject here treated of, very much needed. It is designed as a pocket companion, for the Surveyor, Mechanick, and for those who deal in timber and boards, particularly by its tables of round and square timber, for the Wheelright, the Housecarpenter, Joiner, Cooper, and many other Dealers and Craftsmen, as well as the Grocer, for gauging expeditiously. How far the author has succeeded in his views, and endeavours to render it useful to mankind, must be decided by the test of experience.

# RECOMMENDATIONS.

Having duly examined the inclosed work, in manuscript, I am constrained and deem it proper, to recommend it to the patronage of a genereous publick, as being a valuable and useful production; valuable from its tendency, to bring into general use, that which has, hitherto, been known to but few; useful, in vastly abridging the labour of Arithmetical and Mathematical calculations, that the surveyor and artist have frequently to make, also in containing some things, never before known to have been published.

CYRUS CARPENTER,
*Physician, and Mathematician.*

Whiting, Vt. May 24, 1824.

Having been thoroughly convinced by daily experience that a work like the present was much needed as well by the mechanick as by the mathematician and the surveyor, it was with no inconsiderable degree of interest that I gave it a perusal. After having attentively and minutely examined it, I find that the author has correctly anticipated the defects of works of this description in use, and has admirably supplied them. He has not only very much abridged the labour of many mathematical estimations; and simplified many processes which were formerly tedious and perplexing; but has embodied in his work many interesting facts which are original; or at least not to be found in similar productions. Upon the whole, I consider the work well calculated to promote the interests of mathematical science, and sincerely hope it will meet with that liberal reception from an intelligent publick, which its merits deserve.

SAMUEL BEACH, *County Surveyor.*
*Addison County, Vt.*

We, the subscribers, have perused with some degree of pleasure, a Treatise on Gunter's Scale, &c. prepared for the press, by George Curtis, and have minutely exam-

ined that part which relates to the measurment of timber and boards by the Sliding Rule, and do cheerfully recommend it as being an easy and concise way of getting the contents of solid bodies of every description; and the ready calculated tables of round and square timber which never have appeared in any work of this kind, cannot fail to render it valuable to all those who deal in lumber.

ISAAC COLLINGS,
*Inspector of Lumber.*
ASA EDDY.

Whitehall, August 24, 1824.

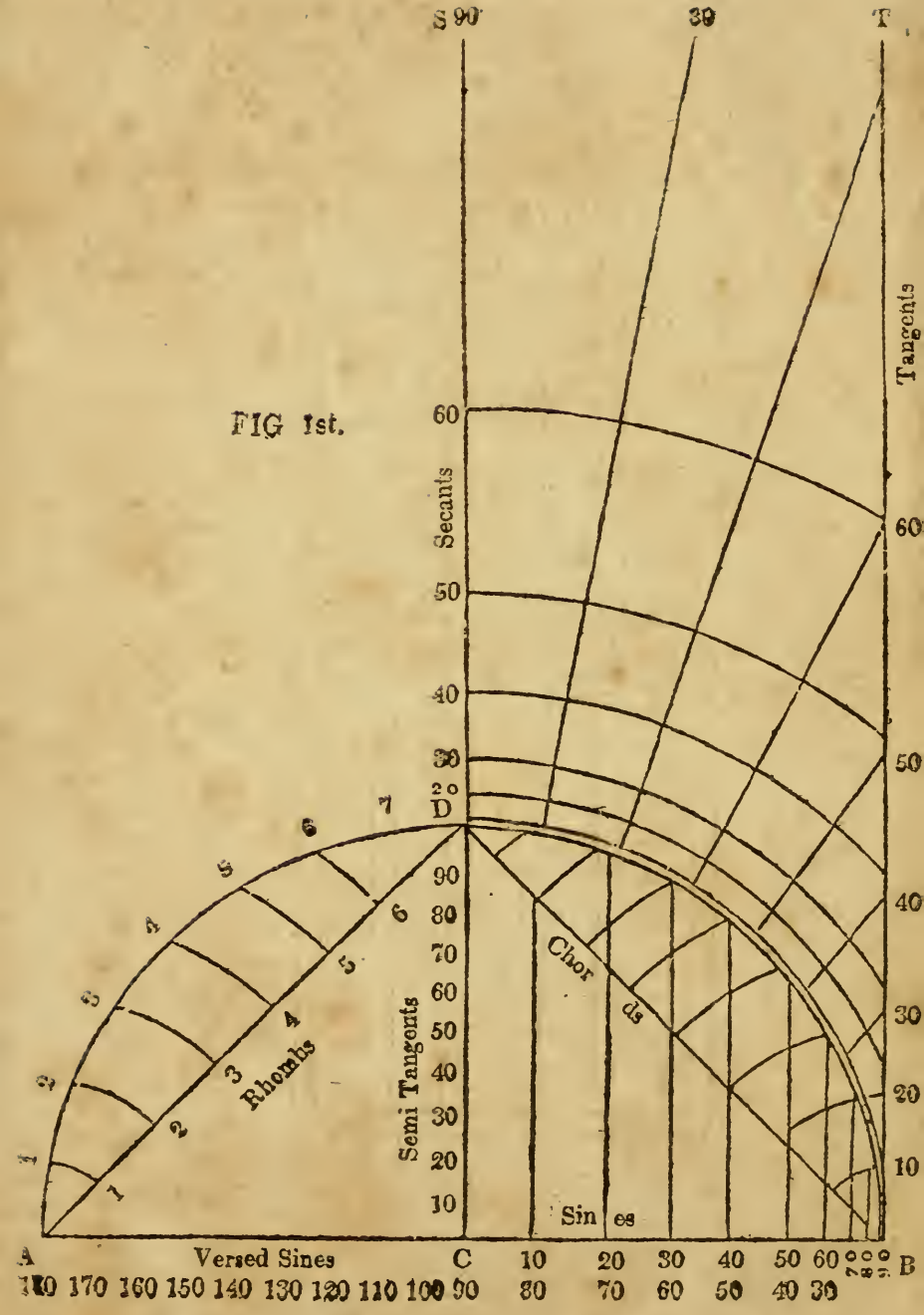
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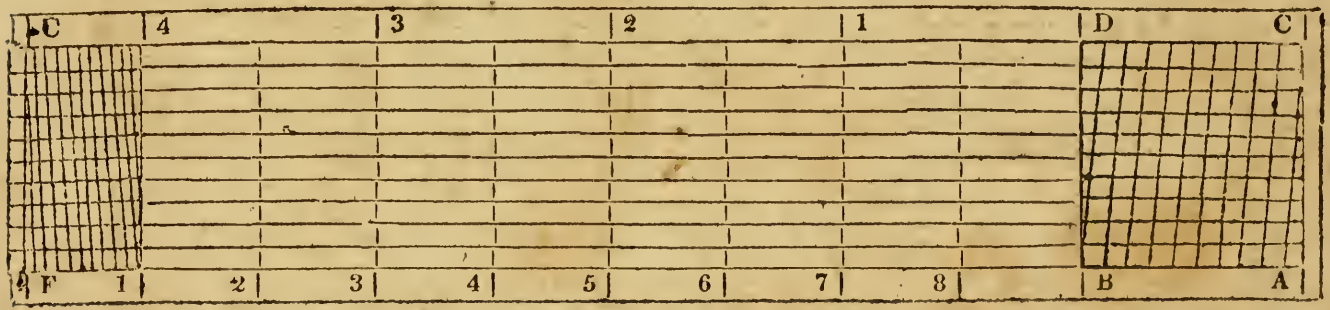
FIG 1st.

## PLAIN SCALE, FIG 2d.

## DIAGONAL SCALE, FIG 3d.



# CONSTRUCTION OF THE PLAIN SCALE.

1. With the radius intended for the scale, describe a semicircle, (see plate 1st fig 1st,) and from the centre C, draw CD, perpendicular to AB, which will divide the semicircle into two quadrants, AD, BD; continue CD towards S, draw BT, perpendicular to CB, and join BD and AD.

2. Divide the quadrant BD into 9 equal parts, then each of these divisions will be 10 degrees. Subdivide each of these parts into single degrees, and if your radius will admit of it, into minutes, or some equal parts of a degree, larger than a minute.

3. Set one foot of the compasses at B, and transfer each of the divisions of the quadrant BD, to the right line BD, then BD will be a Line of Chords.

4. Then the points, 10, 20, 30, &c. in the quadrant BD, draw right lines, parallel to CD, to cut the radius CB, and they will divide that line into a line of sines, which must be numbered from C towards B.

5. If the same line of sines be numbered from B towards C it will become a line of versed sines, which may be continued to 180 degrees, if the same divisions be transferred on the same line on the other side of the centre C.

6. From the centre C, through the several divisions of the quadrant BD, draw right lines till they cut the tangent BT so the line BT, will become a Line of Tangents.*

7. Set one foot of the compasses at C, extend the other to the several divisions, 10, 20, 30, &c. in the tangent line BT, and transfer these extents, severally, to the right line CS, then that line will be a Line of Secants.

8. Right lines draw from A to the several divisions 10,

* A mistake was made in engraving this plate. The lines running parallel with C D, and the curved lines between B D, and the lines falling from the Tangents should intersect each other on the semicircle A D B; and the last mentioned lines should run in a direction to centre at C.

20, 30, 40, &c. in the quadrant BD will divide the the radius CD into a line of semi-tangents.

9. Divide the quadrant AD into 8 equal parts, and from A as a centre, transfer these divisions severally into the line AD, then AD will be a Line of Rhombs, each division answering 11 degrees and 15 minutes upon the Line of Chords. The use of this division, or line, is for measuring angles, and protracting them, according to the common divisions of the Mariner's Compass. If the radius AC be divided into 100, or 1000, &c. equal parts, and the length of the several sines, tangents, and secants, corresponding to the several arches of the quadrant, be measured thereby, and these numbers set down in a table, each in its proper column, you will by these measures have a collection of numbers, by which the several cases in Trigonometry, may be solved. Right lines, graduated as above mentioned, being placed severally upon the Rule, form the instrument called the Plain Scale, (see plate 1st fig 2d,) by which the line and angles of all triangles may be measured. All right lines as the sides of plain triangles, &c. when they are considered simply as such, without having relation to a circle, are measured by scales of equal parts, each of which is subdivided into ten equal parts; and this serves as the common divisions to all the rest. In most Scales, an inch is taken for a common measure, and whatever an inch is divided into, may be found at the end of the Scale: divided in this manner, any number less than 100, may be readily taken. But if the number should consist of three places of figures, the value of the third figure, cannot be exactly ascertained; and in this case, it is better to use a Diagonal Scale, by which any number consisting of three places of figures, may be exactly found. The figures of this Scale are given in plate 1st, fig 3d; its construction is as follows: Having prepared a ruler of a convenient breadth for your Scale, draw near the edges, two right lines, AF, CC, parallel to each other; divide one of these lines, as FA into equal parts, according to the size of your Scale, and through each of these divisions, draw right lines perpendicular to AF, to meet CC, then divide the breadth into ten equal parts; and through each of these divisions, draw right lines, parallel to AF and CC. Divide the lines AB, CD, into ten equal parts, and from the point A to the

first division in the line CD, draw a right line parallel to that line; draw right lines through all their divisions, and the Scale is finished.

Besides the lines already mentioned, there is another on some Scales, and on the Gunter's Scale, marked ML, which is joined to a line of chords, and shows how many miles of Easting and Westing corresponds to a degree of Longitude in every degree of Latitude.* These several lines are generally put on one side of a Rule two feet long, and on the other side is laid down a scale of Logarithms of the sine tangents and numbers, which is commonly called Gunter's Scale, and as it is of general use, it requires a particular description, which will be found on the thirteenth page.

* As it would confuse the adjoined figure, to describe on it the line of Longitude, it is neglected; but the construction is as follows: divide the line CB, into 60 equal parts, and through each point draw lines parallel to CD to intersect the arch BD. Take B as a centre, transfer the several points of intersection, to the line BD, and their number is from D towards B, from 0 to 60, and it will be the Line of Longitude.

## HOW TO PROVE THE SLIDING RULE.

Rule.—Draw out the slider to the right hand, till 1 on the slider coincides with 2 on the fixed part, then 2 on the slider will coincide with 4 on the fixed part. Continue to draw the slider till 1 on the slider coincides with 3 on the fixed part, then 2 on the slider will coincide with 6 on the fixed part; till 1 on the slider coincides with 4 on the fixed part, then 2 on the slider will coincide with 8 on the fixed part; till 1 coincides with 5, then 2 will coincide with the centre 1; till 1 coincides with 5½, then 2 will coincide with 11; till 1 coincides with 6, then 2 will coincide with 12; and thus continue to do till you have gone through the line, and if the Rule is correctly graduated, each number will correspond as above stated; if they do not correspond, the Rule is not correct, and consequently will not give a correct answer.

# GUNTER'S SCALE.

Gunter's Scale has upon it eight lines :

1. Sine Rhombs, (marked SR) corresponding to the Logarithms of Natural Sines of every point of the Mariner's Compass, numbered from the left hand towards the right, with 1, 2, 3, 4, 5, 6, 7 to 8, where is a brass pin ; this line is also divided, where it can be done, into halves and quarters.

2. Tangent Rhombs, (marked TR) corresponds to the Logarithms of the tangents of every point of the Compass, and is numbered 1, 2, 3 to 4, at the right hand, where there is a pin ; and thence towards the left hand with 5, 6, 7 ; it is also divided, where it can be done, into halves and quarters.

3. The line of numbers, (marked NUM) corresponds to the Logarithms of numbers, and is marked thus : at the left hand it begins at 1, and towards the right hand are 2, 3, 4, 5, 6, 7, 8, 9, and 1 in the middle ; at which, is a brass pin ; then 2, 3, 4, 5, 6, 7, 8, 9 and 10 at the end, where there is another pin. The value of these numbers and their intermediate division, depends on the estimated values of the extreme numbers, 1 and 10 ; and as this line is of great importance, a particular description of it and its uses, will be given.

The first 1, may be counted for 1, or 10, or 100, or 1000, and then the next 2 is accordingly, 2, or 20, or 200, or 2000, &c. Again, the first 1 may be reckoned one tenth or one hundredth, or one thousandth part, &c. and then the next 2 is two tenth, or two hundredth, or two thousandth parts, &c. &c. Then, if the first 1, be reckoned 1, the middle 1 is reckoned 10 and 2, at its right hand is 20, 3 is 30, 4 is 40, and 10, at the end is 100 ; Again, if the first 1 is 10, the next 2 is 20, 3 is 30, and so on, making the middle 1, 100, the next 2 is 200, the next 3 is 300, 4 is 400, and 10 at the end is 1000. In like manner, if the first 1 be esteemed one tenth part, the next 2 is two tenth parts, and the middle 1 is one, and the next 2 is two, and 10 at the end is ten. Again, if the first 1 be counted one hundredth part, the next 2 is two hundredth parts, the middle 1 is now ten hundredth parts, the next two hundredth parts, the

middle 1 now is ten hundredth parts, or one tenth part; and the next 2 is two tenth parts, and 10 at the end is counted 1. As the figures are increased or diminished in their value, so in the like manner, must all the intermediate strokes or subdivisions, be increased or diminished; that is, if the first 1 at the left hand be counted 1, then 2 next following is 2, and each subdivision between them now is one tenth part, and so all the way to the middle 1, which now is 10, the next is 20;—now the longer strokes between 1 and 2 are to be counted from the centre 1, (11, 12,) where is a brass pin, then 13, 14, 15, sometimes a longer stroke than the rest; then 16, 17, 18, 19, 20, at the figure 2; and in the same manner the short strokes between the figures 2 and 3, and 4 and 5, &c. are to be reckoned as units. Again if 1 at the left hand be 10, the figures between it and the middle 1, are common tens; and the subdivisions between each figure are units; from the middle 1, to 10 at the end, each figure is so many hundredths: and between these figures each longer division is ten. From this description it will be easy to find the divisions representing any given number; thus, suppose the point representing the number 12, were required, take the division at the figure 1, in the middle for the first figure of 12, then for the second figure count two tenths, on longer strokes to the right hand, and this last is the point representing 12, where the brass pin is. Again, suppose the number 22, were required; the first figure begins 2, 1. Take the division to the figure 2, and for the second figure 2, count two tenths onward and that is the point representing 22. Again, suppose 1728 were required. For the first figure, 1, take the middle 1; for the second figure, 7, count onward as before, and that is 1700, and as the remaining figures are 28, or nearly 30, note the point which is nearly $\frac{1}{10}$, for the distance between the marks 7 and 8, and this will be the point representing 1728. If the point representing 435 was required: from the 4 in the second interval count towards 5 on the right, three of the larger divisions and one of the smaller, (this smaller division being midway between the marks 3 and 4,) and that will be the division expressing 435, and the like of other numbers, which by a little practice is easily done.

All fractions found in this line must be decimals, and if

they are not, they must be reduced to decimals; which is easily done by extending the compasses from the denominator to the numerator; that extent laid the same way from 1 in the middle or right hand, will reach to the decimal required.

EXAMPLE.

To find the decimal fraction equal to $\frac{3}{4}$; extend from 4 to 3, that extent will reach from 1 on the middle to 75 towards the left hand; the like may be observed of any other vulgar fraction.

Multiplication is performed on this line by extending from 1 to the multiplier, that extent will reach from the multiplicand to the product. Suppose, for example, it were required to find the product of 16 multiplied by 4: extend from 1 to 4; that extent will reach from 16 to 64, the product required.

Divsion, being the reverse of Multiplication, therefore, extend from the divisor to unity; that extent will reach from the dividend to the quotient. Suppose 64 to be divided by 4; extend from 4 to 1; that extent will reach from 64 to 16=the quotient.

Questions in the Rule of Three are solved by this line, as follows. Extend from the first term to the second—that extent will reach from the third term to the fourth, or answer.

It ought to be particularly noticed, that if you extend to the left from the first number or term to the second, you must also extend to the left from the third to the fourth, and vice versa.

EXAMPLE.

If the diameter of a circle be 7 inches, and the circumference 22 inches, what is the circumference of another circle, whose diameter is 14 inches?

Extend from 7 to 22; that extent will reach from 14 to 44, the same way.

The superficial contents of any Parallelogram are found by extending from 1 to the breadth; that extent will reach from the length to the superficial contents.

EXAMPLE.

Suppose a plank or board to be 15 inches wide and 27 feet long. The contents are required.

Extend from 1 foot, to 1 foot 3 inches, (or 1,25;) that

extent will reach from 27 feet to 33,75 = the superficial contents. Or, you may extend from 12 inches 15, &c.

The solid contents of any Bale, Box, Chest. &c. is found by extending from 1 to the breadth, that extent will reach from the depth to a fourth number; and the extent from 1 to that fourth number, will reach from the length to the solid contents.

EXAMPLES.

1. What is the solid contents of a square pillar, whose length is 21 feet 9 inches, breadth 1 foot 3 inches?

The extent from 1 to 1,25 will reach from 1,25 the depth, to 1,56, = the contents of 1 foot in length. Again, the extent from 1 to 1,56, will reach from the length = 21,75, to 33,9 or 34, nearly = the solid contents in feet.

2. Suppose a square piece of timber 1,25 foot wide, and 0,56 foot deep, and 36 feet long, be given, to find the solid contents.

Extend from 1 to 7; that extent will reach from 36 to 25,2 = the solid contents. In like manner may the contents of Bales be found, which divided by 40, will give the tonnage.

4. The Line of Sines, (marked SIN) corresponding to the Logarithmick Sines of the degrees of the Quadrant begins at the left hand, and is numbered towards the right; thus, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, then 20, 30, 40, &c. ending at 90°, where is a brass centre pin, as there is at the right hand of the lines.

5. The Line of Versed Sines, (marked VS) corresponding to the Log. Versed Sines of the degrees of the Quadrant, begins at the right hand against 90° on the sine; and from thence is numbered towards the left hand; thus, 10, 20, 30, and 40, &c. ending at the left hand, at about 169°. Each of the subdivisions from 10 to 30 is, in general two degrees; from thence to 90, is single degrees; from thence to the end, each degree is divided into 15 minutes.

6. The line of Tangents, (marked TANG) corresponding to the Log. Tangents of the degrees of the Quadrant, begins at the left hand, and is numbered towards the right; thus, 1, 2, 3, 4, and so on to 10, 20, 30, 40 and 45, where is a brass pin under 90° on the Sines; from thence it is numbered backwards 50, 60, 70, 80, &c. to 89, ending at the left hand

where it begins at 1 degree. The subdivisions are nearly similar to those of the Sines. When you have any extent in your dividers to be set off from any number less than 45° on the line of Tangents towards the right, and it is found to reach beyond the mark of 45°, you must see how far it extends beyond that mark, and set it off towards the left, and mark what degree it falls upon ; which will be the number sought, and must exceed 45°. If, on the contrary, you are to set off such a distance to the right, from a number greater than 45°, you must proceed as before, only remember, that the answer will be less than 45°, and you must always consider the degrees above 45°, as if they were marked on the continuation of the line to the right hand of 45°.

7. The line of the Meridional parts, (marked MER,) begin at the right hand, and is numbered thus, 10, 20, 30, to the left hand, where it ends at 87°

8. This line, with the line of equal parts, (marked EP) under it, are used together, and only in Mercator's sailing. The upper line contains the degrees of the meridian, or latitude in Mercator's Chart, corresponding to the degrees of longitude on the lower line. The use of this scale in solving the usual Problems of Trigonometry, plain sailing, middle latitude sailing, and Mercator's sailing, will be given in the course of this work ; but it will be unnecessary to enter into an explanation of its use in calculating the common Problems of Nautical Astronomy, it is more accurate to perform by Logarithms.

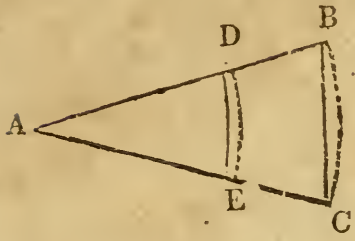
## DESCRIPTION AND USE OF THE SECTOR.

This instrument consists of two rules or legs, representing the radius, moveable round an axis or joint, the middle of which, represents the centre, from whence several scales are drawn on the faces ; some of the scales are single, others double. The single scales are like those on a common Gunter's scale ; the double scales are those that proceed from the centre ; each of these being laid twice on the same face of the instrument viz. once on each leg. From these scales dimensions or distances are to be taken

when the legs of the instrument are set in an angular position. The single scales being used exactly like Gunter's scale, I shall proceed to enumerate a few of the uses of the double scales, the number of which is seven; viz. the scale of lines, (marked LIN or L.) The scales of chords, (marked CHO or C.) The scale of sines, (marked SIN or S.) The scale of tangents, to 45° and another scale of tangents, from 45° to about 76° both of which are marked TAN or T. The scale of secants, (marked SEC or S.) And the scale of polygons, (marked POL.) The scale of lines, chords, sines and tangents, under 45° are all of the same radius, beginning at the centre of the instrument, and terminating near the other extremity of each leg, viz. the lines at the division 10; the chord at 60°; the sine at 90°; and the tangents at 45°. The remainder of the tangents, or those above 45° are other scales, beginning at a quarter of the length of the former, counting from the centre, where they are marked with 45°, and extend to about 76°. The secants also begin at the same distance from the centre, where they are marked with 0, and are thence continued to 75 deg. The scales of polygons are set near the inner edge of the legs, and where these scales begin, they are marked 4; and from thence are numbered backwards, on towards the centre 12. In describing the use of the Sector, the terms Lateral Distance, and Transverse Distance, often occur.

By the former is meant the distance taken with the compasses on one of the scales only, beginning at the centre of the sector. By the latter is meant the distance taken between any two corresponding divisions of the scales of the same name, the legs of the sector being in an angular position. The use of the sector depends upon the proportionability of the corresponding sides of similar triangles; demonstrated in Art. 53 Geometry. For, if in the triangle ABC we take AB=AC and AD=AE, and draw DE and BC, it is evident that DE and BC, will be parallel.—Therefore, by the above mentioned proposition AB:BC :: AD:DE; so, whatsoever part AD is of AB, the same part DE will be of BC; hence if DE be the chord, sine or tangent of any arch to the radius AD, so BC will be the same to the radius AB.

The line, of lines, is useful to divide a given line in-




to any number of equal parts, or in any proportion, or to find the 3d and 4th proportionals, or to increase a given line in any proportion.

EXAMPLES.

1. To divide a given line into any number of equal parts, as, suppose 9. Make the length of the given line, a transverse distance to 9, and 9 the number of parts proposed; then will the transverse distance of 1 and 1, be one of the parts, or $\frac{1}{9}$ part of the whole; and the transverse distance of 2 and 2, will be two of the equal parts, or $\frac{2}{9}$ of the whole line, &c.

2. If a man should travel 52 miles in 8 hours, how far would he travel in 3 hours at the same rate?

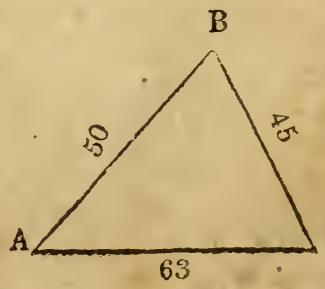
Take 52 in your compasses as a transverse distance, and set off from 8 to 8, then the transverse distance 3 and 3, being measured laterally, will be found equal to $19\frac{1}{2}$, which is the number of miles required.

3. Having a chart, constructed upon a scale of 6 miles to an inch, it is required to open the sector, so that a corresponding scale may be taken from the line of sines.—Make the transverse distance 6 and 6, equal to the lateral distance 3 and 3; then set off any distance from the chart laterally, and the corresponding transverse distance, will be the reduced distance required.

4 One side of any triangle being given of any length; to measure the other two sides, on the same scale.

Suppose the side AB, of the triangle ABC, measure 50, what are the measures of the other two sides?

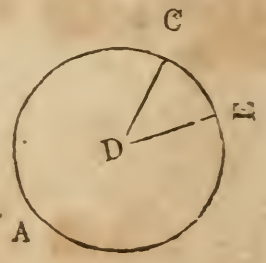
See fig. Take AB in your dividers, apply it transversely to 50 and 50, to this opening of the sector, apply the distance AC in your compasses to the same number on both sides of the rule, transversely; and where the two points fall, will be the measure on the line of lines,



the distance required; the distance AC, will fall against 63 and 63, and BC against 45 and 45 on the line of lines.

The line of chords on the sector is very useful for protracting any angle, when the paper is so small, that an arch cannot be drawn upon it with the radius of a common line of chords. Suppose it was required to set off an arch of 30°, from the point C, of the small circle ABC; take the radius in your compasses, and set it off transversely, from 60° to 60° on the line of chords. Then take the transeverse extent from 30° to 30° on the chords; and place one foot of the compasses at C, the other will reach to E and CE will be the arch required. By the converse operation, any angle or arch, may be measured; with any radius describe an arch about the angular point: set that radius transversely from 60° to 60°. Then take the distance of the arch, intercepted between the two legs, and apply it transversely to the chords, and it will shew the degrees of the given angle.

*Note.* When the angle to be protracted exceeds 60°, you must lay off 60°; and then the remaining parts; or if it be above 120°, lay off 60° twice; and then the remaining parts.—In this way any arch above 60° may be measured.




## USE OF THE LINES OF SINES, TANGENTS AND SECANTS.

By the several lines disposed on the sector, we have scales of several radii. So that,

1. Having a length or radius given, not exceeding the length of the sector when opened, we can find the chord, sine, &c. of the same. Thus, suppose a chord, sine or tangent of 20°, to a radius of 2 inches be required. Make 2 inches the transverse opening to 60° and 60° on the chords; then will the same extent reach from 45° to 45°

on the tangents, and from 90° to 90° on the sines, so that to whatever radius the line of chords is set, to the same are all the others set also. In this disposition, therefore, if the transverse distance between 20° and 20° on the chords be taken with the compasses, it will give the chord of 20° ; and if the transverse of 20° and 20°, be in like manner taken on the sines, it will be the sine of 20° ; and lastly if the transverse distance of 20° and 20° be taken on the tangents, it will be the tangent of 20°, to the same radius of 2 inches.

2. If the chord, or tangent of 70° were required ; for the chord you must first set off the chord of 60°, or the radius upon the arch, and then set off the chord of 10°, to find the tangent of 70°, to the same radius the scale of upper tangents must be used ; the under one only reaching to 45°, making, therefore, two inches, the transverse distance 45°, and 45° at the beginning of the scale, the extent between 70°, and 70° on the same, will be the tangent of 70°, to 2 inches radius.

3. To find the secant of any arch ; make the given radius the transverse distance between 0, and 0 on the secants; then will the transverse distance of 20° and 20°, or 70° and 70°, give the secant of 20° or 70° respectively.

4. If the radius, and any line representing a sine, tangent or secant, be given ; the degrees corresponding to that line, may be found by setting the sector to the given radius, according as a sine, tangent or secant is concerned ; then taking the given line between the compasses, and applying the two feet transversely to the proper scale, and sliding the feet along till they both rest on, like divisions on both legs, then the divisions will shew the degrees, and parts corresponding to the given line.

## USE OF THE LINE OF POLYGONS.

The use of this line is to inscribe a regular polygon in a circle. For example ; let it be required to inscribe an octagon in a circle. Open the sector, till the transverse distance, 6 and 6 be equal to the radius of the circle ; then will the transverse distance of 8 and 8, be the side of the inscribed octagon, or polygon.

# USE OF THE SECTOR IN TRIGONOMETRY.

All proportions in Trigonometry are easily wrought by the double lines on the sector; observing that the sides of triangles are taken off the line of lines, and the angles are taken off the sines, tangents or secants, according to the nature of the proportion. Thus, in the triangle ABC, we have given AB = 56, AC = 64, and the angle ABC = 46° 30′ to the rest in this case. We have (by art, 58 geometry) the following proportion: as AC (64) sine of the B (46° 30′) : : AB (56) : to the sine of the angle C, and as the sine B : is to the side AC : : so is the sine A : to the side BC; therefore to work these proportions by the sector, take the lateral distance 64 = AC from the line of lines, and open the sector to make this a transverse distance of 46° 30′ = angle B on the sines; then take the lateral distance 56 = AB on the line of lines, and apply it transversely on the sines, which will give 39° 24′ = to C; hence the sum of the angles B and C is 58° 54′ which taken from 180°, leaves the angle A = 94° 6′, then to work the secant proportion, the sector being set at the same opening as before, take the transeverse distance of 94° 6′ = the angle A on the sines, or which is the same thing, the transeverse distance of its supplement 85° 54′; then this applied laterally to the lines, gives the side sought BC = 88. In the same manner we might solve any problem in trigonometry, with the tangents and secants, instead of measuring them on the sines, as in the preceeding example.

All the problems that occur in nautical-astronomy, may be solved by the sector; but the calculations by logarithms are much more accurate.

## THE SLIDING RULE

Consists of a fixed part and a slider, and is of the same dimensions as a common Gunter's scale; and has the same

lines marked on the fixed part, as that scale has, and also on the plain scale ; and these lines may be used with a pair of compasses, in the same manner, as the lines of those scales.

As a description of those lines, has already been given, it will be unnecessary to repeat it here : It being sufficient to observe, that there are two lines of numbers, viz : a line of Logarithmick sines, and a line of Logarithmick tangents on the slider. And the slider may be shifted, so as to fix either face of it on either side of the fixed part of the scale, according to the nature of the question to be solved.

In solving any problem in Arithmetick, Trigonometry, plain sailing &c. let the proportion be so stated, that the first and third terms may be alike, and of course, the second and fourth terms will be alike. Then bring the first term of the analogy on the fixed part, against the second term on the slider ; and against the third term on the fixed part, will be found the fourth term on the slider. Or if necessary, the first and third terms may be found on the slider, and the second and fourth on the fixed part. Multiplication and Division are performed by this rule or method ; only consider unity as one of the terms of the analogy.

## MULTIPLICATION BY THE SLIDING RULE.

To perform multiplication, set 1 on the line of numbers of the fixed part, against one of the factors on the line of numbers on the slider ; then against the other factor on the fixed part will be found the product on the slider.

*Note.* If the first and second terms are alike, or of one name, instead of the first and third, you must bring the first term on the slider, against the third on the fixed part, and against the second term on the slider, will be found the fourth term on the fixed part ; or if necessary the first and second terms may be found on the fixed part, and the third and fourth on the slider.

### EXAMPLES.

1. To find the product of 5, by 12. Draw out the slider, till 1 on the fixed part, coincides with 5 on the slider ; then opposite 12 on the fixed part, will be found 60 = the product, on the slider.

2. To find the product of 50, by 12. Not moving the slider, count 5 to be 50; count 12 as before; then opposite 12 on the fixed part, will be found 600 on the slider.

3. Place the slider as before, count 5 to be 500, and 12 to be 1200; the answer, 600,000; will be found on the slider.

4. To find the product of 17 by 25. Draw out the slider till 1 on the fixed part, coincides with 17 on the slider, then opposite 25 on the fixed part, will be found 425 on the slider.

5. To find the product of 17 by 17. Draw out the slider, till 1 on the fixed part coincides with 17 on the slider, then opposite 17 on the fixed part, will be found 289 on the slider.

6. Place the slider the same as before; against 50 on the fixed part will be found 850 on the slider.

7. The slider laying at 17 as before, count 50 or 5 to be opposite 500 on the fixed part, will be found 8500 on the slider.

8. Place the slider as before, count 17 to be 1700, count 3 to be 300 on the fixed part, then opposite 300 on the fixed part will be found 510,000 on the slider.

9 To find the product of $21\frac{1}{2}$ by 20. Draw out the slider till the centre 1 on the fixed part coincides with $21\frac{1}{2}$ on the slider, then opposite 20 on the fixed part will be found 430 on the slider.

10 To find the product of 5 by $2\frac{1}{2}$ count the first 1 on the fixed part, to be $\frac{1}{10}$, the centre one count 1, draw out the slider till 1 on the fixed part coincides with 5 on the slider, opposite $2\frac{1}{2}$ on the fixed part will be found $12\frac{1}{2}$ on the slider.

## DIVISION BY THE SLIDING RULE.

Place the divisor on the line of numbers of the fixed part against 1 on the slider, then against the dividend found on the fixed part, will be found the quotient on the slider.

### EXAMPLES

1 To divide 60 by 5. Set 5 on the fixed part against 1 on the slider, then against 60 on the fixed part, will be found 12 =the quotient on the slider.

2. To divide 400 by 27. Set 27 on the fixed part against 1 on the slider, then against 400 on the fixed part, will be found $14\frac{2}{27}$ or about $14\frac{4}{5}$ on the slider.

3. To answer several questions, not moving the slider in in one lesson, the slider placed as in Example 2.

| Divisors. | Dividends. | Quotients. |
|---|---|---|
| 27 | –:– 400 | $14\frac{2}{27}$ or $14\frac{4}{5}$ |
| 27 | –:– 500 | $18\frac{14}{27}$ or $18\frac{1}{2}$ |
| 27 | –:– 600 | $22\frac{2}{9}$ or $22\frac{1}{4}$ |
| 27 | –:– 700 | $25\frac{25}{27}$ or 26 nearly |
| 27 | –:– 800 | $29\frac{17}{27}$ or $29\frac{2}{3}$ |
| 27 | –:– 850 | $31\frac{13}{27}$ or $31\frac{1}{2}$ |
| 27 | –:– 900 | $33\frac{1}{3}$ |
| 27 | –:– 1000 | $37\frac{1}{27}$ or 37 |

You will have gone the length of the fixed part to A, on the statement.

4. To divide any number from 700 to 6000 that is at B on the slider, the full of the extent of the slider. From the statement, draw out the slider on A, to the left hand of the centre 1, to the figure 6, representing 60 on the fixed part, over 1 on the slider; then against 7 representing 700, on the fixed part, will be found $11\frac{2}{3}$ on the slider. Now, not moving the slider, you may find this lesson from 700 to 6000.

| Divisors. | Dividends. | Quotients. |
|---|---|---|
| 60 | –:– 700 | $11\frac{2}{3}$ |
| 60 | –:– 800 | $13\frac{1}{3}$ |
| 60 | –:– 900 | 15 |
| 60 | –:– 1000 | $16\frac{2}{3}$ |
| 60 | –:– 2000 | $33\frac{1}{3}$ |
| 60 | –:– 3000 | 50 |
| 60 | –:– 4000 | $66\frac{2}{3}$ |
| 60 | –:– 5000 | $83\frac{1}{3}$ |
| 60 | –:– 6000 | 100 |

Ending at B, at the right hand of the slider.

## EXAMPLES IN THE RULE OF THREE BY THE SLIDING RULE.

If 3 lbs. of beef cost 21 cents, what will, from 30 to 100 lbs. cost?

This lesson reaches from 30 to 70 different statements, viz. from 30 to 100, not moving the slider ; bring 3 on the letter A, of the fixed part, on the line of numbers against 21 on the line marked B, on the slider ; then against 30 on the fixed part on A, will be found on the slider, $2,10 ; and against 35 lbs. will be 2,45 ; 40—2,80 ; 50—3,50, 60—4,20 ; 75—5,25 ; 90—6,30 ; 100—7,00.

2. If $4\frac{1}{2}$ yds. cost $23, what will 20 yds. cost ?

RULE.

Draw out the slider, till $23 coincides with $4\frac{1}{2}$ on the fixed part ; then against 20 on the fixed part, will be found $102, on the slider. Now not moving the slider, at A, on the fixed part, 100 yds. will be found to the answer on the slider = $5,11.

3. If 4 lbs. of sugar cost $1,50, what will 20 lbs. cost ?

Bring 4 on the line of numbers on the fixed part, against $1,50 on the line of numbers on the slider ; then against 20 on the line of numbers, on the fixed part, will be found $7,50 on the slider. Now not moving the slider, against 40, on A, will be found $15,00 on the slider. Again, not moving the slider, against 80, on A, will be found $30,00 ; and at A, 100 lbs on the slider, B will be found $37,50—ABCD on the right of the rule.

4. To find the circumference of a circle, whose diameter shall be 20.

RULE.

Draw out the slider, till 22 on the slider coincides with 7 on the fixed part, then against 20 on the fixed part, will be found $62\frac{6}{7}$ or $62\frac{3}{4}$ on the slider. Again, not moving the slider, against 25 on the fixed part, will be found $78\frac{4}{7}$ on the slider. Again, not moving the slider, against 40 on the fixed part. will be found $125\frac{5}{7}$ on the slider. Again, not moving the slider, against 60 on the fixed part, will be found $188\frac{4}{7}$ on the slider. Now, not moving the slider, against 100 at A, on the fixed part, will be found $314\frac{2}{7}$ on the slider.

5. If one yard of cloth cost $9,00, what will $\frac{5}{16}$ of a yard cost ?

Draw out the slider, till 9 on the slider coincides with 16 on the fixed part, then against 5 on the fixed part, will be found on the slider $2,83.

## BOARD MEASURE BY THE SLIDING RULE.

EXAMPLES.

1. To measure a board 12 feet long, and 12 inches wide: 12 on the fixed part, to the right of the centre 1 counts 12 feet in length; but 12 on the slider give 12 to 12, or 12 feet.

2. A board 12 feet long, and 19 inches wide.

Draw out the slider, till 19 coincides with 12 on the fixed part, that makes the board 19 feet=the answer on the slider; 19 inches the answer in feet.

3. A board 14 feet long and 20 inches wide.

Draw out the slider till 20 coincides with 12 on the fixed part, then against 14 on the fixed part, the answer $23\frac{1}{3}$ ft.

4. A board 22 feet long, 20 inches wide.

Draw out the slider till 20 inches coincides with 12 on the fixed part, and against 22 on the fixed part, will be found the answer $36\frac{3}{4}$ feet on the slider.

5. A board table that extends from 4 to 100 feet in length, and 36 inches wide.

Draw out the slider, till 36 coincides with 12 on the fixed part; count the 1st 1 on the fixed part 10; begin at 4 on the fixed part 4, so on to 10 at the centre, and so on to 100 on the right hand, to A. Begin on the slider at 4, and reckon at different lengths.

| Fixed part. | Slider. | Fixed part. | Slider. |
|---|---|---|---|
| 4 | 12 | $33\frac{1}{3}$ | 100 |
| 5 | 15 | 40 | 120 |
| 6 | 18 | 50 | 150 |
| 7 | 21 | 55 | 165 |
| 8 | 24 | 60 | 180 |
| 10 | 30 | $66\frac{2}{3}$ | 200 |
| 12 | 36 | 70 | 210 |
| 15 | 45 | 75 | 225 |
| 20 | 60 | 80 | 240 |
| 25 | 75 | 90 | 270 |
| 30 | 90 | 100 | 300 |

6. A log 14 feet long cuts 27 boards, each board 36 inches wide, how many feet in one board ?

Ans, 42 feet.

How many feet in the 27 boards ?

Draw the slider till 27 coincides with the centre 1, against 42 on the fixed part, will be the answer on the slider= to 1134.

A log 12 feet long, 24 inches in diameter, cuts 15 boards, 20 inches broad.

Draw out the slider, till 20 is against 12 ; 20 will be the answer for one board. Draw out the slider till 15 comes against the centre 1 on the fixed part, and against 20 on the fixed part will be found 300 on the slider= the answer in board measure.

A log 2 feet in diameter, and under ; 2 inches on each side are allowed for slab, and $\frac{1}{5}$ for saw calf, and 1 board for wane : and from 24 to 36 inches diameter, 3 inches for slab, $\frac{1}{5}$ for saw calf, and 2 boards for wane.

A log 28 inches at the small end, will cut 18 boards, only 16 measured.

Draw out the slider till 22= the breadth of the board, comes against 12, and against 14 =the length on the fixed part, will be found the answer on the slider for one board $=25\frac{3}{5}$. Now draw out the slider till 16, the number of boards, comes against the centre 1 : now to find the rest, say the log was 14 feet long, your answer on the slider is 414 feet nearly.

Again, a log 14 feet long, 36 inches at the small end slabbed, leaves the board 30 inches wide, $\frac{4}{5}$ for sawcalf, leaves 24 and 2 wane leaves 22. Draw out the slider till 30 comes against 12 on the fixed part, and under 14 on the fixed part, will be found 35 on the slider. Then draw out the slider till 22 comes against the centre 1, and against 35 will be found 770 on the slider, which will be the answer for a log 36 inches in diameter, and 14 feet long.

A log 20 inches at the small end, and 16 feet long, cuts 13 boards that are 16 inches wide, and but 12 measured, how many feet ? Ans. 255

A log 16 inches in diameter, 14 feet long, cuts 9 boards, and but 8 measured, how many feet ? Answer 112 feet on the slider.

## TO MEASURE SQUARE TIMBER IN SOLID FEET BY THE SLIDING RULE.

RULE.

Draw out the slider to the left hand, till the length of the timber found on the slider, shall correspond to 12 on the girt line; then against the inches, the stick is square on the girt line, will be found the number of cubic feet on the slider.

EXAMPLE. To measure a stick of timber 60 feet long, and from 5 to 40 inches square.

Draw the slider to the left hand, till 6 on the slider (which call 60,) corresponds with 12 on the girt line, and against 5 on the slider, will be found $10\frac{42}{100}$ on the girt line. The same answer can be found by drawing the slider to to the right, but the divisions are not so easily distinguished, without more practice.

By letting the slider remain, you may solve all the questions proposed above in a short time, and will put their answers in a table for exercise.

| Inches sqr. | Cubic feet in the stick. | Inches sqr. | Cubic feet in the stick. | Inches sqr. | Cubic feet in the stick. |
|---|---|---|---|---|---|
| 5 | 10,42 | 14 | 82 | 23 | 220 |
| 6 | 15 | $14\frac{1}{2}$ | 88 | $23\frac{1}{2}$ | $231\frac{3}{4}$ |
| 7 | 20,42 | 15 | 94 | 24 | 242 |
| $7\frac{1}{2}$ | $23\frac{1}{3}$ | $15\frac{1}{2}$ | $100\frac{1}{2}$ | $24\frac{1}{2}$ | 250 |
| 8 | $26\frac{2}{3}$ | 16 | $106\frac{1}{2}$ | 25 | 260 |
| $8\frac{1}{2}$ | $30\frac{1}{10}$ | 17 | $120\frac{1}{3}$ | 26 | $282\frac{1}{2}$ |
| 9 | $33\frac{1}{2}$ | 18 | 135 | 27 | 303 |
| $9\frac{1}{2}$ | $37\frac{2}{3}$ | $18\frac{1}{2}$ | 142 | 28 | 327 |
| 10 | $41\frac{2}{3}$ | 19 | 150 | 29 | 352 |
| $10\frac{1}{2}$ | 46 | $19\frac{1}{2}$ | $158\frac{1}{3}$ | 30 | 375 |
| 11 | 50,42 | 20 | $166\frac{2}{3}$ | 31 | 402 |
| $11\frac{1}{2}$ | 55 | $20\frac{2}{4}$ | $174\frac{2}{4}$ | 32 | 426 |
| 12 | 60 | $20\frac{3}{4}$ | 180 | 35 | 510 |
| $12\frac{2}{4}$ | $65\frac{1}{5}$ | 21 | $184\frac{2}{4}$ | 38 | 602 |
| 13 | $70\frac{2}{4}$ | 22 | 202 | 40 | 667 nearly. |

In this table the timber is all 60 feet.

## TO MEASURE HEWN TIMBER THAT IS NOT SQUARE, BY THE SLIDNG RULE.

EXAMPLES.

1. To find the solid feet in a stick of timber, 50 feet in length, and 7 by 10 inches.

Draw out the slider, till 50 coincides with 12 on the girt line, and against the thickness, 7 inches, found on the girt line you will find 17 on the slider, which is the answer, at 7 inches square. There will then remain 3 times 7=21 inches, and 50 feet long, yet to find; to obtain which, draw the slider to the right, till 21 on the slider coincides with 12 on the line marked A; then against, 50, the length found on A, you will find $87\frac{3}{4}$ on the slider; this must be divided by 12 and it will give 7 feet $3\frac{3}{4}$, inches or $7\frac{1}{4}$, which being added to the 17, before found, gives $24\frac{1}{4}$ feet, contained in the stick.

2. To find the solid feet in a stick 45 feet long, 27 inches wide, and 22 inches thick.

Draw out the slider, till 45 on the slider coincides with 12 on the girt line, then over 22, found on the girt line, will be $151\frac{2}{4}$ on the slider, which gives the dimensions of a stick 45 feet long and 22 inches square. Now $5\times22$ remain=110, which number find on the slider, and let it coincide with 12 on A; then against 45 on A, you will find 413 on the slider; this divided by 12 gives $34\frac{1}{3}$ which added to $151\frac{2}{4}$ before found, gives 186 nearly, for the answer.

3. To find the solid feet in a stick of timber, 60 feet long, 30 inches wide and 14 inches thick.

Draw out the slider, till 60 on the slider, coincides with 12 on the girt line, then over 14 on the girt line, you will find $81\frac{2}{3}$ on the slider; now by doubling this, will give the contents, equal to 28 by 14, and the 2 left is 2 by 14, which is $\frac{1}{7}$ of 14; divide $81\frac{2}{3}=11\frac{2}{3}$; then add $81\frac{2}{3}$ $81\frac{2}{3}$ $11\frac{2}{3}=175$ the answer. Or find the avarage square=20,5. Then find 20,5 on the girt line, and directly over it on the slider will be 175; observing to draw out the slider, till the length of the stick in feet coincides with 12 on the girt line.

4. To find the solid feet of a stick of timber, 55 feet long, 25 inches wide and 20 thick.

Draw out the slider, till 55 coincides with 12 as before ; then over 20, found on the girt line, will be 153 nearly ; this divided by 4, and the quotient added gives 191⅓ feet the answer. Or for the 5 inches left, say 5 times 20 is= 100 ; the square root of which is 10 : now look on the slider over 10, will be found 38⅓ as before.

A little practice will render the performance easy and expeditious.

Where it is practicable, cast it into a square ; as 9 by 4, multiplied, gives 36, the square root of which is=6 the answer. Or cast the log into board measure, by drawing the slider against 30, the width, on the slider under 12 on the fixed part A ; then under 60, the length on the fixed part, you will find 150 on the slider,==number of square feet in one board ; then lay 14, the width on the slider, under 1 on the fixed part, then against 150 on the fixed part, will give 2100 feet of boards on the slider ; now divide by 12 by drawing 1 on the slider, against 12 on the fixed part, then against 2100 on the fixed part will be found 175 on the slider, the answer in cubic feet.

## GUAGING OF ROUND TIMBER, OR TAKING A GUAGE POINT, AND CASTING INTO CUBIC FEET.

RULE. Let your guage point, found on the girt line be 13,54 inches ; now to find the contents of a stick or log, bring the length of the timber, found on the slider, to coincide with the above guage point ; then the diameter in inches or parts, found on the girt line, will coincide with the number of cubic feet on the slider.

EXAMPLE. Suppose a stick of timber 12 feet long, and 15 inches in diameter ; how many cubic feet ?

Against 15 inches, will be found 15 feet,
" 20 " " " 26¾ "
" 30 " " " 59 "
" 35 " " " 30,8 "

# MENSURATION.

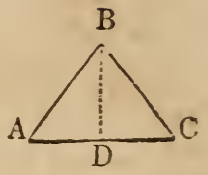
PROBLEM I.

*To find the Area of a Triangle.*

Multiply the base by half the perpendicular; or multiply half the base by the whole perpendicular, and the product will be the area required.

EXAMPLE. Given AC, the base = 30 feet, and the perpnedicular BD = 20.

| | |
|---|---|
| 30 = base. | 15 = half base. |
| 10 = half perp. | 20 = perp. |
| 300 = area. | 300 = area. |




PROBLEM II.

*To find the Area of a Circle.**

Square the diameter of the circle, and multiply that square by the decimal ,7854, which decimal, is as much less than unity or 1, as the inscribed circle is to its superscribing square. Or which is nearly the same, multiply the square by 11 and divide by 14.

---

* The circumference of any circle may be found, by multiplying the diameter by 22 and dividing that product by 7, or multiplying the diameter by 355 and dividing by 113, which numbers may be easily remembered, by observing, that the two numbers being set together, thus, 113,355 make a double series of odd numbers viz. 11, 33 and 55. The circumference of any circle being given, the diameter may be found, by reversing the above rule. Thus, multiply the circumference by 7 and divide by 22, or better, multiply by 113 and divide by 355. Or you may divide the circumference by 3,1416, or to find the circumference, multiply the diameter by 3,1416.

EXAMPLE. A circle whose diameter DB = 10,6.

```
   10,6                 112,36 = square.
   10,6                     11
   ----                 -------
    636            14) 1235,96 (88,282
  106.                 112
  -------              -----
  112,36 = sqare.       115
   ,7854                112
  -------              -----
   44944                 39
  56180                  28
 89888                   ---
78652                    116
--------                 112
88,247544 = area.        ---
                          40
```

PROBLEM III.

*To find the Area of an Ellipsis, or Oval.*

Multiply the longest or transverse diameter, by the shortest or conjugate diameter, and this product by ,7854, and the last product will be the area.

EXAMPLE. Suppose the transvesre AC = 12 and the conjugate BD = 10

```
   12
   10
  ----
  120
 ,7854
 -----
94,2480 area
```

*Definition.* A sector of a circle is a part of a circle bounded by two radii, or semidiameters, and by an arch of the primitive circle whose area may be found by means of the whole area of the whole circle: Thus, as 360 degrees, is to angle or degrees between the two legs or radii of the sector, so is the area of the whole circle, to the area of the sector.

Sector.

area.

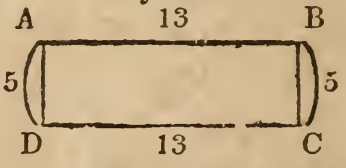
EXAMPLE. As 360° : 288° : : 314,16 : 251,328° the Ans.

PROBLEM IV.

*To find the Solidity of a Cylinder.*

Multiply the square of the diameter of either end or base by ,7854 which will give the area of the base; then multiply this area by the length and it will give the solidity required.

Cylinder.




EXAMPLE. AD or BC = 5

5

25 = square of the diameter of

,7854 the base or end.

100

125

200

175

19,6350 = area of the base or end.

13

58905

19635

25,5255 = solidity of the cylinder in feet.

PROBLEM V.

*To find the Solidity of a Grindstone.*

Grindstones in the form of cylinders, are sold by the stone of 24 inches diameter and 4 inches thick : Now, to know how many such stones are contained in a given cylinder, multiply the square of the diameter, in inches, by the thickness, in inches, and divide the product by 2304 and you will have the number required.

EXAMPLE

How many stones of 24 inches diameter and 4 thick, are contained in a stone of 36 inches diameter and 8 inches thick ?

36 inches diameter.
36

216
108

1296 = square.
8 = thickness.

2304) 10368 (4,5 Ans. = 4 1-2 stones.
9216

11520
11520

This problem may be solved very expeditiously, by means of the line of numbers on Gunter's scale, by the following rule. Extend from 48 to the diameter : continue that extent three times its length, from the thickness, and it will reach to the number of stones required So in the foregoing example, extend from 48 to 36 the diameter : continue that esten} three times its length, from the thickness, which is 8 inches, and it will reach to 4,5 or 4 1-2 the answer.

PROBLEM VI.

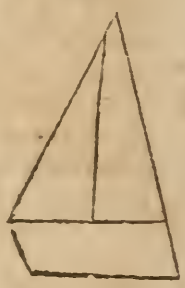
*To find the Solidity of a Pyramid or Cone.*

First find the area of the base, whether square, triangular or circular, or any other form, by the proper rule for each; then multiply this area by one third the perpendicular height, and it will give the solidity required.

EXAEPLES.

1. What is the solidity of a pyramid which has a square base, whose side is 4 feet, and perpendicular hight 6 feet.

1st.



4
4

16 = area
2 = ⅓ height.

32 = solidity.

2. What is the solidity of a cone whose base is 10,6 feet, and perpendicular height is 30 feet.

2d.

10,6 = diameter of the base
10,6

112,36 = square.
,7854

88,247544 = area.
10 = ⅓ height. = 30

882,475440 = solidity.

This solidity divided by 40, will give the number of tons in that cone.

40) 882,475440

22,061886 = tons

PROBLEM VII.

*To find the Tonnage of a Ship.*

By a law of Congress of the United States of America, the tonnage of a ship is to be found in the following manner.

"If the vessel be double decked, take the length thereof, from the fore part of the main stern to the after part of the stern post above the upper deck; the breadth thereof, to be taken at the broadest part above the main wale, half of which breadth, shall be accounted the depth of such vessel; then deduct from the length three fifths of the breadth, then multiply the remainder by the breadth and this product by the depth, divide this last product by ninety-five, and the quotient will be the true contents or tonnage of such vessel. If the vessel be single decked, take the length and breadth, as above directed, in a double decked vessel; and deduct from the length, three fifths of the breadth; and taking the depth from the under side of the deck plank to the ceiling in the hold; then multiply and divide as above directed, and the quotient will be the true contents or tonnage of such vessel."

EXAMPLE. If the length of a double decked vessel, be 80 feet, and the breadth 24 feet, what is her tonnage?

| | | |
|---|---|---|
| 80 ft. length | 95) | 18892,8 (198,871 Ans. |
| 14,4, $\frac{3}{5}$ the breadth. | | 95 |
| 65,6 | | 939 |
| 24 breadth. | | 855 |
| 2624 | | 842 |
| 1312 | | 760 |
| 1574,4 | | 828 |
| 12 depth, or $\frac{1}{2}$ the breadth. | | 760 |
| 18892,8 to be divided by 95. | | 680 |
| | | 665 |
| | | 150 |

*Note.* Ship carpenters, in finding the tonnage, multiply the length of the keel, by the breadth of the main beam, and the depth of the hold in feet, and then divide the product by 95; the quotient is the number of tons. In double decked vessels, half the breadth is taken for the depth

## GUAGING OF CASKS.

Having found the number of cubic inches in any body, by the preceding rules, you may from thence, determine their contents, in gallons, bushels, &c. by dividing that number of cubic inches, by the number of cubic inches in a gallon, bushel, &c. respectively. A wine gallon, by which most liquors are measured, contains 231 cubic inches. A beer, ale, or milk gallon, contains 282 cubic inches. A bushel of corn, malt, &c. contains 2150,4 cubic inches. This measure is subdivided into 8 gallons; each of which contains 268,8 cubic inches. In all the following rules, it supposes the dimensions of a cask or vessel, to be given in inches, and decimal parts of an inch.

### PROBLEM I.

*To find the number of Gallons or Bushels in a Vessel of a Cubic Form.*

Divide the cube of one of the sides in inches by 231, and it gives wine gallons, divide the same cube by 282 and it gives beer gallons; and divide by 2150,4 and it gives the number of bushels the vessel will hold.

EXAMPLE. Required the number of wine and beer gallons, also the bushels contained in a cubic box or cistern whose side is 50 inches.

50
50

2500
50

231) 125000 (541,1 gallons, wine measure.
1155

950
924

260
231

290
230

59

282) 125000 (443,26 gallons, beer measure.
1128

1220
1128

920
846

740
564

1760

2150,4) 125000,0 (58,1 bushels.
107520

174800
172032

27680

PROBLEM II.

*To find the number of Gallons or Bushels contained in a body of a Cylindrical Form.*

Multiply the square of the diameter of either end or base, by the length of the cylinder, and divide the product by 294,12 and the quotient will be the number of wine gallons divide the same number by 359,05 the quotient will be the number of beer or ale gallons; and divide the product by 2738 and the quotient will be the number of bushels.

*Note.* The above numbers for divisors are found by dividing 231, 282 and 2150,4, by the decimal ,7854.

EXAMPLE. Required the number of wine gallons, in the cylinder delineated in the figure of problem 4, of mensuration. The diameter of its base, being 5 feet = 60 inches, and the length 13 feet = 156 inches.

| | | |
|---|---|---|
| 60 | 294,12) 561600,00 | (1909,42 Ans. |
| 60 | 29412 | |
| 3600 | 267480 | |
| 156 | 264708 | |
| 21600 | 277200 | |
| 18000 | 264708 | |
| 3600 | 124920 | |
| 561600 dividend. | 117648 | |
| | 72720 | |

Here observe, that two cyphers are affixed to the product to equal the number of decimals in the divisor, which makes the quotient the number of gallons; but the other cyphers added to the remainder, gives decimals.

PROBLEM III.

*To find the number of Gallons or Bushels contained in a body of the form, of a Pyramid or Cone. See figure in Problem 6, of Mensuration.*

Multiply the area of the base of the pyramid or cone, by one third of its perpendicular height; the product divided by 231 will give the answer in wine gallons; divide by 282 it will give the answer in beer gallons; and divide by 2150,4 and it will give the answer in bushels.

EXAMPLE. Required the number of beer gallons, contained in a pyramid, whose base is 30 inches square, and perpendicular height is 60 inches?

30 inches, side of the
30 square base.

900
20 $\frac{1}{3}$ the height

Inches in a beer gal. 282) 18000 (63,8 Ans.
1692

1080
846

2340
2256

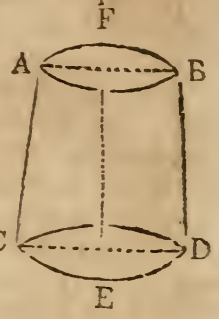
84

PROBLEM IV.

*To find the number of Gallons or Bushels contained in a Vessel in the form of a Frustum of a Cone.*

Multiply the top and bottom diameters together, and to the product add one third of the square of the difference of the same diameters, then multiply this sum by the perpendicular height, and divide the product by 292,12 for wine gallons; by 359,05 for beer gallons; and by 2738 for bushels.

EXAMPLE. Given the diameter DC = 40 inches; the diameter AB = 30 inches, and the perpendicular height FE = 60 inches; the contents in wine gallons are required.




40 bottom diameter
30 top diameter

10 difference
10

3) 100 sqr. of the difference

33,3 = $\frac{1}{3}$ the square

30 top diameter
40 bottom diameter

1200
33,3

1233,3
60 perpendicular height

294,12) 73998,00 (251,59 gallons, wine measure.
58824

151740
147060

46800
29412

173880
147060

268200

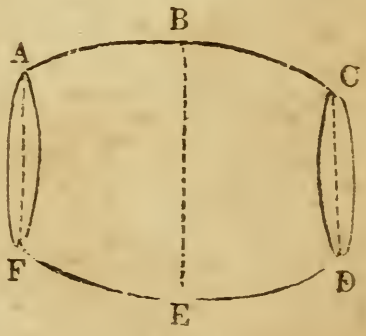
PROBLEM V.

*To Guage a Cask.*

To guage a cask, measure the head diameters FA and DC, and if they differ, take the mean of them, that is, add the diameters of each head together and divide the sum by 2 ; measure also the diameter EB at the bung, taking the measure, inside of the cask ; then measure the length of the cask, making due allowance for the thickness of the heads : Having these measures, you can calculate the contents in gallons or bushels, by the following rule :

Take the difference between the head and bung diameters, multiply this difference by ,62 and add the product to the head diameter, the sum will be the mean diameter ; multiply the square of this by the length of the cask, and divide the product by 294,12 for wine, by 359,05 for beer gallons, and by 2738 for bushels. The decimal ,62 is commonly used by guagers, to find the mean diameter ; but if the staves are nearly straight, it would be more accurate to use ,55 or less. If on the contrary, they are very curving we should use ,64, ,65, or more. When the staves are straight, the decimal ,51 may be used.

EXAMPLE. Given the bung diameter BE 34,5 inches, the head diameter AF or CD=30,7, after allowing for the thicknes of the heads; 59,3 inches the length, find the number of wine gallons this cask will hold.



34,5 bung diameter.
30,7 head do.

3,8
,62

76
228

2,356
30,7 head diameter.

33,056 mean do.
33,056

198336
165280
99168
99168

1092,699136 call the decim. 67
1092,67
59,3 length on the inside.

327801
983403
546335

294,12) 64795,331 (220,3 Ans.
58824

59713
58824

88931
88236

695

Calipers are used by guagers, in taking the dimensions of casks, but a common rule, or a staff may be used. A more

expeditious way of finding the contents of casks, is by the line of numbers on Gunter's scale ; or on the sliding rule ; in order to perform which, make marks on the scale, on the calipers, at the points 17,15 and 18,95 inches and at 52,33 inches, which numbers are the square roots of 294,-12, and 359,05, and of 2738 respectively. A brass pin is generally fixed on the calipers at each of these points, which are called the guage points. Having prepared the scales in this manner, you may calculate the number of gallons or bushels, by the following rule :

Extend from 1 towards the left hand to ,62, or less, if the staves be nearly straight ; that extent will reach from the difference between the head and bung diameters, to a number at the left hand, which number added to the head diameter, will give the mean diameter ; then put one foot of the compasses on the guage point=17,15, for wine gallons, 18,95, for beer gallons, and at 52,33, for bushels ; and extend the other foot of the compasses to a number denoting the mean diameter ; this extent turned over twice the same way from the length of the cask, will give the number of gallons or bushels respectively.

In the preceding example, the extent from 1 to ,62 will reach from 3,8 to 2,4, nearly, which added to 30,7 gives the mean diameter=33,1, then the extent from the guage point, 17,15 to 33,1 turned over twice from the length 59,-3, will reach to 220,9, wine gallons. If you had used the guage point 18,95 the answer would have been in beer gallons ; or if you had used 52,33 the answer would have been in bushels.

## GUAGING CASKS BY THE SLIDING RULE.

On the line marked D, you may find the guage point, marked WG ; you will see that you can find 17,15 inches, a little to the right of the long mark, that is over the centre of G ; also over AG on the same scale you will find 18,-95, or $18\frac{19}{20}$, very near the long mark over the centre of G, here is the guage point for the ale or beer gallons, as the other was for wine gallons. Set the length of the cask found on the slider, against the guage point on D ; and a-

gainst the mean diameter on D, the answer will be found on the slider.

In measuring the length of a cask, we allow for the thickness of both heads, 1 inch, $1\frac{1}{2}$ or 2 inches, according to the size of the cask.

*Note.* You must take the head diameter, close to its outside, and for small casks add $\frac{3}{10}$ inch, for casks of 30, 40, or 50 gallons, add $\frac{4}{10}$ inch, and for larger casks add 5 or 6 tenths and the sum will be very near the head diameter within.

In taking the bung diameter, observe in moving the rod or staff backward and forward, to see if the staves opposite the bung, be thicker or thinner than the rest, if so, make the necessary allowance.

EXAMPLE. Given the bung diameter BE= 34,5 inches, the head diameter AF, or CD= 30,7 inches.

Length of the cask within= 59,3.

34,5
30,7
2) 65,2
32,6
,5
33,1= mean diameter.

Now draw out the slider, till 59,3 on the slider, coincides with the guage point on the girt line, for wine gallons, and against 33,1 on the girt line, will be found on the slider=220,9 wine gallons.

PROBLEM VI.

*The guage point for bushels is placed on the girt line, at* 13,$\frac{385}{1000}$ *inches, as it would run off the rule on the right.— For the points for gallons, reverse it back to the left of those points.*

Draw out the slider, till the length of a square box or bin, coincides with the guage point on the girt line, to wit against $13\frac{385}{1000}$ inches, then against the number of inches

the box is square, found on the girt line; and on the slider will be found the number of bushels.

EXAMPLES.

1. Given 7,75 inches square and 30 feet in length, also beginning at 7,75, and extend to 40 inches square.

Against 7,75, will be found 10 bushels.

| | | | | | |
|---|---|---|---|---|---|
| " | 9 | " | " | $13\frac{1}{2}$ | " nearly. |
| " | 10 | " | " | $16\frac{3}{4}$ | " |
| " | 12 | " | " | 24 | " |
| " | 13,40 | " | " | 30 | " |
| " | 15 | " | " | $37\frac{3}{4}$ | " |
| " | 17 | " | " | $48\frac{1}{4}$ | " |
| " | 19 | " | " | 60 | " |
| " | 20 | " | " | $66\frac{2}{3}$ | " |
| " | 21 | " | " | $73\frac{1}{3}$ | " |
| " | 24,5 | " | " | 100 | " nearly. |
| " | 25 | " | " | $104\frac{2}{3}$ | " |
| " | 27 | " | " | $121\frac{1}{2}$ | " |
| " | 29 | " | " | $140\frac{1}{2}$ | " |
| " | 30 | " | " | 150 | " |
| " | 35 | " | " | 208 | " |
| " | 40 | " | " | $267\frac{1}{2}$ | " |

When the bin is more than 40 inches, say 60 inches, and 20 feet long, draw the slider to the left hand till 20 feet, the length found on the slider, coincides with the guage point found on the girt line, to wit, 13,385 inches; then against the width of the bin, namely 60 inches, which found on the girt line, will be found on the slider 399, calling the figures on the girt line tens, and those on the slider will be hundreds; and so of any other number.

2. Suppose a bin 30 feet long, and from 40 to 245 inches square.

Against 40 will be found 267 bushels.

| | | | | | |
|---|---|---|---|---|---|
| " | 60 | " | " | $598\frac{1}{2}$ | " |
| " | 100 | " | " | 1675 | " |
| " | 120 | " | " | 2500 | " |
| " | 150 | " | " | 3790 | " |
| " | 190 | " | " | 6000 | " |
| " | 245 | " | " | 9950 | " |

To find how many bushels any cylindrical cask will contain; or how many bushels of timber any log will contain, providing it be a complete cylinder.

Draw the slider, till the guage point, 15,001, or nearer, 15,0015, found on the girt line, coincides with the length of the cylinder in feet, found on the slider; then against the diameter of the cylinder, found on the girt line in inches, will be the number of bushels found on the slider.

EXAMPLE. Suppose the cylinder 300 feet laid to the guage point, then against 7, or 70 inches for a diameter, you will find 6444 bushels, the answer on the slider.

## TO CUT OFF ANY NUMBER OF CUBIC FEET OF ANY DIAMETER, OF ROUND TIMBER.

Suppose the number of feet required to be cut off, be 3, and the diameter be $7\frac{1}{2}$ inches.

Draw out the slider till 3 coincides with $7\frac{1}{2}$ on the fixed part, then against the guage point 13,54 inches will be found the length to be cut off.

EXAMPLES.

1. If $2,15 buy 1 foot of timber how much will $10 buy? 4,65 cubic feet, Ans.

2. This timber is 4,3 inches in diameter; what is the length of the stick?

Lay 4,65 feet on the slider, against 4,3 inches, on the girt line, and against 13,54 inches on the girt line will be found 46,5 feet, the length of the stick on the slider.

For square timber, draw the slider so that the number of inches the stick is square, found on the fixed part, coincides with the number of feet on the slider; then against 12 will be found the number of feet in length to be cut off.

## TO CAST INTEREST ON THE SLIDING RULE FOR ONE YEAR.

Let the principal or number of dollars be found on A, and put the per cent on the slider against the centre 1; then against the principal, will be found the interest, calling dollars, cents. To cast interest for days, find the days for

one year or 365, on the fixed part A ; then draw the slider till the interest for one year before found, coincide with the 365 days ; now, on the fixed part A, notice the number of days you want to get the interest for, and under that on the slider, will be found the interest for the days required.

EXAMPLES.

1 What is the interest $333,33 for one year and twenty-five days, at 6 per cent. First for one year, by the above directions, will be found $20 ; now notice 365 days on A, and draw the slider till $20 coincides with it or under 365 days, then look for 25 days on A, and on B, under 25 will be $1,33$\frac{1}{3}$ the answer for 25 days.

2 What is the interest of $1000 for one year and thirty-six days at 7 per cent. Draw out the slider till 7 on the slider coincides with the centre 1 and against 1000 on the right hand at A, will be found 70 on the slider. Then lay 70 on the slider against 365 days on the fixed part and against 36 on the slider will be found $6,88 Ans. $76,88.

*A Table, for the use of Coopers, in calculating Cisterns.*

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wine gallons and parts of gallons. | 1/4 | 0 | 2 | 1 | 2 | 0 | 2 | 0 | 0 | 2 | 1 | 2 | 0 | 1 | 2 | 3 | 1 | 0 | |
| | 555 | 590 | 665 | 725 | 810 | 890 | 977 | 1060 | 1175 | 1285 | 1387 | 1548 | 1742 | 1892 | 1827 | 2143 | 2345 | 2622 | |
| Smallest head in feet and inches. | 00 | 02 | 04 | 06 | 08 | 10 | 00 | 02 | 04 | 06 | 08 | 10 | 00 | 02 | 00 | 04 | 06 | 07 | |
| | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 5 | 6 | 6 | |
| Largest head in feet and inches. | 00 | 02 | 04 | 06 | 02 | 04 | 06 | 08 | 10 | 00 | 02 | 06 | 10 | 00 | 00 | 03 | 06 | 07 | |
| | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | |
| Depth of the cistern in feet and inches. | 00 | 02 | 04 | 06 | 08 | 10 | 00 | 02 | 04 | 06 | 08 | 10 | 00 | 02 | 06 | 07 | 07 | 07 | |
| | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | |

## A LOG TABLE,

*Showing the number of feet of boards, any log will make, whose diameter, is from 15 to 36 inches at the smallest end, and from 10 to 15 feet in length.*

| Diameter in Inches. | 10 Feet in length. | Diameter in Inches. | 11 Feet in length. | Diameter in Inches. | 12 Feet in length. | Diameter in Inches. | 13 Feet in length. | Diameter in Inches. | 14 Feet in length. | Diameter in Inches. | 15 Feet in length. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 90 | 15 | 99 | 15 | 108 | 15 | 117 | 15 | 126 | 15 | 135 |
| 16 | 100 | 16 | 110 | 16 | 120 | 16 | 130 | 16 | 140 | 16 | 150 |
| 17 | 125 | 17 | 137 | 17 | 150 | 17 | 160 | 17 | 175 | 17 | 187 |
| 18 | 155 | 18 | 170 | 18 | 186 | 18 | 201 | 18 | 216 | 18 | 232 |
| 19 | 165 | 19 | 176 | 19 | 198 | 19 | 214 | 19 | 230 | 19 | 247 |
| 20 | 172 | 20 | 189 | 20 | 206 | 20 | 263 | 20 | 246 | 20 | 258 |
| 21 | 184 | 21 | 202 | 21 | 220 | 21 | 238 | 21 | 256 | 21 | 276 |
| 22 | 194 | 22 | 212 | 22 | 232 | 22 | 263 | 22 | 294 | 22 | 291 |
| 23 | 219 | 23 | 240 | 23 | 278 | 23 | 315 | 23 | 332 | 23 | 333 |
| 24 | 250 | 24 | 276 | 24 | 300 | 24 | 325 | 24 | 350 | 24 | 375 |
| 25 | 280 | 25 | 308 | 25 | 336 | 25 | 364 | 25 | 392 | 25 | 420 |
| 26 | 299 | 26 | 323 | 26 | 346 | 26 | 375 | 26 | 404 | 26 | 448 |
| 27 | 327 | 27 | 367 | 27 | 392 | 27 | 425 | 27 | 457 | 27 | 490 |
| 28 | 360 | 28 | 396 | 28 | 432 | 28 | 462 | 28 | 504 | 28 | 540 |
| 29 | 376 | 29 | 414 | 29 | 451 | 29 | 488 | 29 | 526 | 29 | 564 |
| 30 | 412 | 30 | 452 | 30 | 494 | 30 | 535 | 30 | 576 | 30 | 618 |
| 31 | 428 | 31 | 471 | 31 | 513 | 31 | 558 | 31 | 602 | 31 | 642 |
| 32 | 451 | 32 | 496 | 32 | 541 | 32 | 587 | 32 | 631 | 32 | 676 |
| 33 | 490 | 33 | 539 | 33 | 588 | 33 | 637 | 33 | 686 | 33 | 735 |
| 34 | 532 | 34 | 585 | 34 | 638 | 34 | 691 | 34 | 744 | 34 | 798 |
| 35 | 582 | 35 | 640 | 35 | 698 | 35 | 752 | 35 | 805 | 35 | 863 |
| 36 | 593 | 36 | 657 | 36 | 717 | 36 | 821 | 36 | 836 | 36 | 889 |

*A Table of Specific Gravities of Bodies.*

| | | | |
|---|---|---|---|
| Platina (pure) | 23000 | Clay | 2160 |
| Fine Gold | 19400 | Brick | 2000 |
| Standard Gold | 17724 | Common Earth | 1984 |
| Quicksilver (pure | 14000 | Nitre | 1900 |
| Quicksilver (common) | 13600 | Ivory | 1825 |
| Lead | 11325 | Brimstone | 1810 |
| Fine Silver | 11091 | Solid Gunpowder | 1745 |
| Standard Silver | 10535 | Sand | 1520 |
| Copper | 9000 | Coal | 1250 |
| Copper halfpence | 8915 | Box-wood | 1030 |
| Gun Metal | 8784 | Sea-water | 1030 |
| Cast Brass | 8000 | Common-water | 1000 |
| Steel | 7850 | Oak | 925 |
| Iron | 7645 | Gunpowder, close shaken | 937 |
| Cast Iron | 7425 | Ditto. in a loose heap | 836 |
| Tin | 7320 | Ash | 836 |
| Clear Crystal Glass | 3150 | Maple | 755 |
| Granite | 3000 | Elm | 600 |
| Marble and hard stone | 2700 | Fir | 550 |
| Common green Glass | 2600 | Charcoal | |
| Flint | 2570 | Cork | 240 |
| Common Stone | 2520 | Air at a mean state | $1\frac{2}{9}$ |

*Note.* The several sorts of wood are supposed to be dry. Also, as a cubic foot of water weighs just 1000 ounces avoirdupois, the numbers in this table express, not only the specific gravities of the several bodies, but also the weight of a cubic foot of each, in avoirdupois ounces; and therefore, by proportion, the weight of any other quantity, or the quantity of any other weight, may be known, as in the next two propositions.

PROPOSITION I.

*To find the Magnitude of any Body, from its Weight.*

As the tabular specific gravity of the body,
Is to its weight in avoirdupois ounces,
So is one cubic foot, or 1728 cubic inches,
To its contents in feet, or inches, respectively.

EXAMPLES.

1. Required the contents of an irregular block of common stone, which weighs 1 cwt. or 112 lb ?
Ans. $1228\frac{2}{25}\frac{0}{52}\frac{1}{20}\frac{6}{0}$ cubic inches.

2. How many cubic inches of gunpowder are there in 1 lb. weight ? Ans. $29\frac{1}{2}$ cubic inches nearly.

3. How many cubic feet are there in a ton weight of dry oak ? Ans. $38\frac{1}{1}\frac{3}{8}\frac{8}{5}$ cubic feet.

PROPOSITION II.

*To find the Weight of a Body from its Magnitude.*

As one cubic foot, or 1728 cubic inches,
Is to the contents of the body,
So is the tabular specific gravity,
To the weight of the body.

EXAMPLES.

1. Required the weight of a block of marble, whose length is 63 feet, and breadth and thickness each 12 feet; being the dimensions of one of the stones in the walls of Balbeck ?

Ans. $683\frac{4}{9}$ ton, which is nearly equal to the burden of an East-India ship.

2. What is the weight of 1 pint ale measure, of gunpowder ? Ans. 19 oz. nearly.

3. What is the weight of a block of dry oak, which measures 10 feet in length, 3 feet broad, $1\frac{1}{2}$ feet deep or thick ? Ans. $4335\frac{1}{1}\frac{5}{6}$ lb.

## A TABLE OF SOLID MEASURE OF SQUARE TIMBER,

By the following Table the solid contents, and the value of any piece or quantity of timber stone &c. may be found at sight, from 6 inches to $29\frac{1}{2}$ inches, the side of the square, or one fourth of the girt; and from 14 feet to 92 feet in length. It rises from 6 inches, $\frac{1}{4}$ inch at a time till it rises to $29\frac{1}{2}$ inches, and from 14 feet, 1 foot at a time till it rises

to 92 feet. The number of inches which the side of each stick measures are placed at the top of the two first or left hand columns, and at the top of the two columns at the right hand of each double line. These columns give the length and contents of each stick, and the other two columns which run from the top to the bottom of the page are a continuation of the two first; so the length of the stick will be found in the first and third column from the left hand of the page, and from the right hand of each double line; and in the second and fourth columns the contents. The half feet are not reckoned; that is, when a stick measures, for exanple, 30 cubic feet and 5 inches it is reckoned only 30 feet, and if it measures 30 cubic feet and 7 inches it is reckoned 31 feet, &c. this is the method of reckoning timber in Quebec and Montreal, and in all markets in the United States.

| Side 6 | 51 | 13 | Side 6½ | 51 | 15 | Side 7 | 51 | 17 | Side 7½ | 51 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ft. long. | Ins. | | Ft. long. | Ins. | | Ft. long. | Ins. | | Ft. long. | Ins. | |
| | Cont. | | | Cont. | | | Cont. | | | Cont. | |
| | | 52 | 13 | | 52 | 15 | | 52 | 17 | | 52 | 20 |
| | | 53 | 13 | | 53 | 16 | | 53 | 18 | | 53 | 20 |
| | | 54 | 13 | | 54 | 16 | | 54 | 18 | | 54 | 21 |
| | | 55 | 14 | | 55 | 16 | | 55 | 18 | | 55 | 21 |
| 14 | 3 | 56 | 14 | 14 | 4 | 56 | 16 | 14 | 5 | 56 | 19 | 14 | 5 | 56 | 22 |
| 15 | 4 | 57 | 14 | 15 | 4 | 57 | 17 | 15 | 5 | 57 | 19 | 15 | 6 | 57 | 22 |
| 16 | 4 | 58 | 14 | 16 | 5 | 58 | 17 | 16 | 5 | 58 | 19 | 16 | 6 | 58 | 22 |
| 17 | 4 | 59 | 15 | 17 | 5 | 59 | 17 | 17 | 6 | 59 | 20 | 17 | 6 | 59 | 23 |
| 18 | 4 | 60 | 15 | 18 | 5 | 60 | 18 | 18 | 6 | 60 | 20 | 18 | 7 | 60 | 23 |
| 19 | 5 | 61 | 15 | 19 | 6 | 61 | 18 | 19 | 6 | 61 | 20 | 19 | 7 | 61 | 24 |
| 20 | 5 | 62 | 15 | 20 | 6 | 62 | 18 | 20 | 7 | 62 | 21 | 20 | 8 | 62 | 24 |
| 21 | 5 | 63 | 16 | 21 | 6 | 63 | 18 | 21 | 7 | 63 | 21 | 21 | 8 | 63 | 24 |
| 22 | 5 | 64 | 16 | 22 | 6 | 64 | 19 | 22 | 7 | 64 | 21 | 22 | 8 | 64 | 25 |
| 23 | 6 | 65 | 16 | 23 | 7 | 65 | 19 | 23 | 8 | 65 | 22 | 23 | 9 | 65 | 25 |
| 24 | 6 | 66 | 16 | 24 | 7 | 66 | 19 | 24 | 8 | 66 | 22 | 24 | 9 | 66 | 26 |
| 25 | 6 | 67 | 17 | 25 | 7 | 67 | 20 | 25 | 8 | 67 | 22 | 25 | 10 | 67 | 26 |
| 26 | 6 | 68 | 17 | 26 | 8 | 68 | 20 | 26 | 9 | 68 | 23 | 26 | 10 | 68 | 26 |
| 27 | 7 | 69 | 17 | 27 | 8 | 69 | 20 | 27 | 9 | 69 | 23 | 27 | 10 | 69 | 27 |
| 28 | 7 | 70 | 17 | 28 | 8 | 70 | 21 | 28 | 9 | 70 | 23 | 28 | 11 | 70 | 27 |
| 29 | 7 | 71 | 18 | 29 | 9 | 71 | 21 | 29 | 10 | 71 | 24 | 29 | 11 | 71 | 27 |
| 30 | 7 | 72 | 18 | 30 | 9 | 72 | 21 | 30 | 10 | 72 | 24 | 30 | 11 | 72 | 28 |
| 31 | 8 | 73 | 18 | 31 | 9 | 73 | 21 | 31 | 10 | 73 | 25 | 31 | 12 | 73 | 28 |
| 32 | 8 | 74 | 18 | 32 | 9 | 77 | 22 | 32 | 11 | 74 | 25 | 32 | 12 | 74 | 29 |
| 33 | 8 | 75 | 19 | 33 | 10 | 75 | 22 | 33 | 11 | 75 | 25 | 33 | 13 | 75 | 29 |
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| 35 | 9 | 77 | 19 | 35 | 10 | 77 | 23 | 35 | 12 | 77 | 26 | 35 | 13 | 77 | 30 |
| 36 | 9 | 78 | 19 | 36 | 11 | 78 | 23 | 36 | 12 | 78 | 26 | 36 | 14 | 78 | 30 |
| 37 | 9 | 79 | 20 | 37 | 11 | 79 | 23 | 37 | 12 | 79 | 27 | 37 | 14 | 79 | 31 |
| 38 | 9 | 80 | 20 | 38 | 11 | 80 | 23 | 38 | 13 | 80 | 27 | 38 | 15 | 80 | 31 |
| 39 | 10 | 81 | 20 | 39 | 11 | 81 | 24 | 39 | 13 | 81 | 27 | 39 | 15 | 81 | 31 |
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| 41 | 10 | 83 | 21 | 41 | 12 | 83 | 24 | 41 | 14 | 83 | 28 | 41 | 16 | 83 | 32 |
| 42 | 10 | 84 | 21 | 42 | 12 | 84 | 25 | 42 | 14 | 84 | 28 | 42 | 16 | 84 | 33 |
| 43 | 11 | 85 | 21 | 43 | 13 | 85 | 25 | 43 | 14 | 85 | 29 | 43 | 17 | 85 | 33 |
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| 47 | 12 | 89 | 22 | 47 | 14 | 89 | 26 | 47 | 16 | 89 | 30 | 47 | 18 | 89 | 35 |
| 48 | 12 | 90 | 22 | 48 | 14 | 90 | 26 | 48 | 16 | 90 | 30 | 48 | 19 | 90 | 35 |
| 49 | 12 | 91 | 23 | 49 | 14 | 91 | 27 | 49 | 16 | 91 | 31 | 49 | 19 | 91 | 35 |
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| 21 | 9 | 63 | 28 | 21 | 10 | 63 | 31 | 21 | 12 | 63 | 35 | 21 | 13 | 63 | 39 |
| 22 | 10 | 64 | 28 | 22 | 11 | 64 | 32 | 22 | 12 | 64 | 36 | 22 | 14 | 64 | 40 |
| 23 | 10 | 65 | 29 | 23 | 11 | 65 | 32 | 23 | 13 | 65 | 36 | 23 | 14 | 65 | 41 |
| 24 | 10 | 66 | 29 | 24 | 12 | 66 | 33 | 24 | 13 | 66 | 37 | 24 | 15 | 66 | 41 |
| 25 | 11 | 67 | 30 | 25 | 12 | 66 | 33 | 25 | 14 | 67 | 37 | 25 | 15 | 67 | 42 |
| 26 | 11 | 68 | 30 | 26 | 13 | 68 | 34 | 26 | 14 | 68 | 38 | 26 | 16 | 68 | 42 |
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| 29 | 13 | 71 | 31 | 29 | 14 | 71 | 35 | 29 | 16 | 71 | 40 | 29 | 18 | 71 | 44 |
| 30 | 13 | 72 | 32 | 30 | 15 | 72 | 36 | 30 | 17 | 72 | 40 | 30 | 19 | 72 | 45 |
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| 42 | 18 | 84 | 37 | 42 | 21 | 84 | 42 | 42 | 23 | 84 | 47 | 42 | 26 | 84 | 52 |
| 43 | 19 | 85 | 38 | 43 | 21 | 85 | 43 | 43 | 24 | 85 | 48 | 43 | 27 | 85 | 53 |
| 44 | 19 | 86 | 38 | 44 | 22 | 86 | 43 | 44 | 25 | 86 | 48 | 44 | 27 | 86 | 54 |
| 45 | 20 | 87 | 38 | 45 | 22 | 87 | 44 | 45 | 25 | 87 | 49 | 45 | 28 | 87 | 54 |
| 46 | 20 | 88 | 39 | 46 | 23 | 88 | 44 | 46 | 26 | 88 | 49 | 46 | 29 | 88 | 55 |
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| 16 | 11 | 58 | 40 | 37 | 16 | 12 | 58 | 44 | 41 | 16 | 13 | 58 | 49 | 44 | 16 | 14 | 58 | 54 | 49 |
| 17 | 12 | 59 | 41 | 37 | 17 | 13 | 59 | 45 | 42 | 17 | 14 | 59 | 49 | 45 | 17 | 15 | 59 | 55 | 50 |
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| 22 | 16 | 64 | 44 | 42 | 22 | 17 | 64 | 50 | 45 | 22 | 18 | 64 | 54 | 50 | 22 | 20 | 64 | 59 | 55 |
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| 26 | 18 | 68 | 47 | 46 | 26 | 20 | 68 | 52 | 48 | 26 | 22 | 68 | 57 | 54 | 26 | 24 | 68 | 62 | 59 |
| 27 | 19 | 69 | 48 | 47 | 27 | 20 | 69 | 53 | 49 | 27 | 22 | 69 | 58 | 55 | 27 | 25 | 69 | 63 | 60 |
| 28 | 20 | 70 | 48 | 48 | 28 | 21 | 70 | 54 | 50 | 28 | 23 | 70 | 59 | 56 | 28 | 25 | 70 | 64 | 61 |
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| 38 | 27 | 80 | 55 | 58 | 38 | 29 | 80 | 61 | 60 | 38 | 32 | 80 | 67 | 66 | 38 | 35 | 80 | 73 | 71 |
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| 42 | 29 | 84 | 58 | 62 | 42 | 32 | 84 | 64 | 64 | 43 | 35 | 84 | 70 | 70 | 42 | 38 | 84 | 77 | 75 |
| 43 | 30 | 85 | 59 | 63 | 43 | 33 | 85 | 65 | 65 | 43 | 36 | 85 | 71 | 71 | 43 | 39 | 85 | 78 | 76 |
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| 16 | 16 | 58 | 58 | 16 | 17 | 58 | 63 | 16 | 19 | 58 | 68 | 16 | 20 | 58 | 73 |
| 17 | 17 | 59 | 59 | 17 | 18 | 59 | 64 | 17 | 20 | 59 | 69 | 17 | 21 | 59 | 74 |
| 18 | 18 | 60 | 60 | 18 | 19 | 60 | 65 | 18 | 21 | 60 | 70 | 18 | 23 | 60 | 76 |
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| 21 | 21 | 63 | 63 | 21 | 23 | 63 | 68 | 21 | 25 | 63 | 74 | 21 | 26 | 63 | 79 |
| 22 | 22 | 64 | 64 | 22 | 24 | 64 | 69 | 22 | 26 | 64 | 75 | 22 | 28 | 64 | 81 |
| 23 | 23 | 65 | 65 | 23 | 25 | 65 | 71 | 23 | 27 | 65 | 76 | 23 | 29 | 65 | 82 |
| 24 | 24 | 66 | 66 | 24 | 26 | 66 | 72 | 24 | 58 | 66 | 77 | 24 | 30 | 66 | 83 |
| 25 | 25 | 67 | 97 | 25 | 27 | 67 | 73 | 25 | 29 | 67 | 78 | 25 | 31 | 67 | 85 |
| 26 | 26 | 68 | 68 | 26 | 28 | 68 | 74 | 26 | 30 | 68 | 80 | 26 | 33 | 68 | 86 |
| 27 | 27 | 69 | 69 | 27 | 29 | 69 | 75 | 27 | 32 | 69 | 81 | 27 | 34 | 69 | 87 |
| 28 | 28 | 70 | 70 | 28 | 30 | 70 | 76 | 28 | 33 | 70 | 82 | 28 | 35 | 70 | 88 |
| 29 | 29 | 71 | 71 | 29 | 31 | 71 | 77 | 29 | 34 | 71 | 83 | 29 | 36 | 71 | 90 |
| 30 | 30 | 72 | 72 | 30 | 33 | 72 | 78 | 30 | 35 | 72 | 84 | 30 | 38 | 72 | 91 |
| 31 | 31 | 73 | 73 | 31 | 34 | 73 | 79 | 31 | 36 | 73 | 85 | 31 | 39 | 73 | 62 |
| 32 | 32 | 74 | 74 | 32 | 35 | 74 | 80 | 32 | 38 | 74 | 87 | 32 | 40 | 74 | 93 |
| 33 | 33 | 75 | 75 | 33 | 36 | 75 | 81 | 33 | 39 | 75 | 88 | 33 | 42 | 75 | 95 |
| 34 | 34 | 76 | 76 | 34 | 37 | 76 | 82 | 34 | 40 | 76 | 89 | 34 | 43 | 76 | 96 |
| 35 | 35 | 77 | 77 | 35 | 38 | 77 | 83 | 35 | 41 | 77 | 90 | 35 | 44 | 67 | 97 |
| 36 | 36 | 78 | 78 | 36 | 39 | 78 | 84 | 36 | 42 | 78 | 91 | 36 | 45 | 78 | 98 |
| 37 | 37 | 79 | 79 | 37 | 40 | 79 | 86 | 37 | 43 | 79 | 92 | 37 | 47 | 79 | 100 |
| 38 | 38 | 80 | 80 | 38 | 41 | 80 | 87 | 38 | 44 | 80 | 94 | 38 | 48 | 80 | 101 |
| 39 | 39 | 81 | 81 | 39 | 42 | 81 | 88 | 39 | 46 | 81 | 95 | 39 | 49 | 81 | 102 |
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| 41 | 41 | 83 | 83 | 41 | 44 | 83 | 90 | 41 | 48 | 83 | 97 | 41 | 52 | 83 | 105 |
| 42 | 42 | 84 | 84 | 42 | 45 | 84 | 91 | 42 | 49 | 84 | 99 | 42 | 53 | 84 | 106 |
| 43 | 43 | 85 | 85 | 43 | 46 | 85 | 92 | 43 | 50 | 85 | 100 | 43 | 54 | 85 | 107 |
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| 47 | 47 | 89 | 89 | 47 | 51 | 89 | 96 | 47 | 55 | 89 | 104 | 47 | 59 | 89 | 112 |
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| 17 | 23 | 59 | 80 | 17 | 25 | 59 | 86 | 17 | 26 | 59 | 92 | 17 | 28 | 59 | 98 |
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| 22 | 30 | 64 | 87 | 22 | 32 | 64 | 93 | 22 | 34 | 64 | 100 | 22 | 36 | 64 | 106 |
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| 23 | 41 | 60 | 106 | 23 | 43 | 60 | 113 | 23 | 46 | 60 | 120 | 23 | 49 | 60 | 127 |
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| 28 | 50 | 65 | 115 | 28 | 53 | 65 | 123 | 28 | 56 | 65 | 130 | 28 | 60 | 65 | 138 |
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| 39 | 69 | 76 | 135 | 39 | 73 | 76 | 143 | 39 | 78 | 76 | 152 | 39 | 83 | 76 | 161 |
| 40 | 71 | 77 | 137 | 40 | 75 | 77 | 145 | 40 | 80 | 77 | 154 | 40 | 85 | 77 | 164 |
| 41 | 73 | 78 | 138 | 41 | 77 | 78 | 147 | 41 | 82 | 78 | 156 | 41 | 87 | 78 | 166 |
| 42 | 74 | 79 | 140 | 42 | 79 | 79 | 149 | 42 | 84 | 79 | 158 | 42 | 89 | 79 | 168 |
| 43 | 76 | 80 | 142 | 43 | 81 | 80 | 151 | 43 | 86 | 80 | 160 | 43 | 91 | 80 | 170 |
| 44 | 78 | 81 | 144 | 44 | 83 | 81 | 153 | 44 | 88 | 81 | 162 | 44 | 93 | 81 | 172 |
| 45 | 80 | 82 | 146 | 45 | 85 | 82 | 155 | 45 | 90 | 82 | 164 | 45 | 95 | 82 | 174 |
| 46 | 82 | 83 | 147 | 46 | 87 | 83 | 157 | 46 | 92 | 83 | 166 | 46 | 98 | 83 | 176 |
| 47 | 83 | 84 | 149 | 47 | 89 | 84 | 159 | 47 | 94 | 84 | 168 | 47 | 100 | 84 | 178 |
| 48 | 85 | 85 | 151 | 48 | 91 | 85 | 161 | 48 | 96 | 85 | 170 | 48 | 102 | 85 | 181 |
| 49 | 87 | 86 | 153 | 49 | 92 | 86 | 163 | 49 | 98 | 86 | 172 | 49 | 104 | 86 | 183 |
| 50 | 89 | 87 | 154 | 50 | 94 | 87 | 164 | 50 | 100 | 87 | 175 | 50 | 106 | 87 | 185 |
| | | 88 | 156 | | | 88 | 166 | | | 88 | 176 | | | 88 | 187 |
| | | 89 | 158 | | | 89 | 168 | | | 89 | 177 | | | 89 | 189 |
| | | 90 | 160 | | | 90 | 170 | | | 90 | 189 | | | 90 | 191 |
| | | 92 | 162 | | | 91 | 172 | | | 91 | 182 | | | 91 | 193 |
| | | 92 | 164 | | | 92 | 174 | | | 92 | 185 | | | 92 | 196 |

| Side 18 | | 51 | 115 |
|---|---|---|---|
| Ft. Inch. | Ins. Cents. | 52 | 117 |
| | | 53 | 119 |
| | | 54 | 121 |
| | | 55 | 124 |
| 14 | 31 | 56 | 126 |
| 15 | 34 | 57 | 128 |
| 16 | 36 | 58 | 130 |
| 17 | 38 | 59 | 133 |
| 18 | 40 | 60 | 135 |
| 19 | 43 | 61 | 137 |
| 20 | 45 | 62 | 139 |
| 21 | 47 | 63 | 142 |
| 22 | 49 | 64 | 144 |
| 23 | 52 | 65 | 146 |
| 24 | 54 | 66 | 148 |
| 25 | 56 | 67 | 151 |
| 26 | 58 | 68 | 153 |
| 27 | 61 | 69 | 155 |
| 28 | 63 | 70 | 157 |
| 29 | 65 | 71 | 160 |
| 30 | 67 | 72 | 162 |
| 31 | 70 | 73 | 164 |
| 32 | 72 | 74 | 166 |
| 33 | 74 | 75 | 169 |
| 34 | 76 | 76 | 171 |
| 35 | 79 | 77 | 173 |
| 36 | 81 | 78 | 175 |
| 37 | 83 | 79 | 178 |
| 38 | 85 | 8 | 180 |
| 39 | 88 | 81 | 182 |
| 40 | 90 | 82 | 184 |
| 41 | 92 | 83 | 187 |
| 42 | 94 | 84 | 189 |
| 43 | 97 | 85 | 191 |
| 44 | 99 | 86 | 193 |
| 45 | 101 | 87 | 196 |
| 46 | 103 | 88 | 198 |
| 47 | 106 | 89 | 200 |
| 48 | 108 | 90 | 202 |
| 49 | 110 | 91 | 205 |
| 50 | 113 | 92 | 207 |

| Side 18½ | | 51 | 120 |
|---|---|---|---|
| Ft. Inch. | Ins. Cents. | 52 | 123 |
| | | 53 | 126 |
| | | 54 | 128 |
| | | 55 | 130 |
| 14 | 33 | 56 | 133 |
| 15 | 35 | 57 | 136 |
| 16 | 38 | 58 | 138 |
| 17 | 40 | 59 | 140 |
| 18 | 43 | 60 | 142 |
| 19 | 45 | 61 | 145 |
| 20 | 47 | 62 | 147 |
| 21 | 50 | 63 | 150 |
| 22 | 52 | 64 | 152 |
| 23 | 54 | 65 | 154 |
| 24 | 57 | 66 | 157 |
| 25 | 59 | 67 | 159 |
| 26 | 62 | 68 | 161 |
| 27 | 64 | 69 | 164 |
| 28 | 66 | 70 | 166 |
| 29 | 69 | 7 | 169 |
| 30 | 71 | 72 | 171 |
| 31 | 73 | 73 | 173 |
| 32 | 76 | 74 | 176 |
| 33 | 78 | 75 | 178 |
| 34 | 81 | 76 | 180 |
| 35 | 83 | 77 | 183 |
| 36 | 85 | 78 | 185 |
| 37 | 88 | 79 | 188 |
| 38 | 90 | 80 | 190 |
| 39 | 92 | 81 | 192 |
| 40 | 95 | 82 | 195 |
| 41 | 97 | 83 | 197 |
| 42 | 10 | 84 | 199 |
| 43 | 10 | 85 | 202 |
| 44 | 10 | 86 | 204 |
| 45 | 107 | 87 | 207 |
| 46 | 109 | 88 | 209 |
| 47 | 111 | 89 | 211 |
| 48 | 114 | 90 | 214 |
| 49 | 116 | 91 | 216 |
| 50 | 119 | 92 | 218 |

| Side 19 | | 51 | 126 |
|---|---|---|---|
| Ft. Inch. | Ins. Cents. | 52 | 13 |
| | | 53 | 133 |
| | | 54 | 35 |
| | | 55 | 138 |
| 14 | 35 | 56 | 140 |
| 15 | 37 | 57 | 143 |
| 16 | 40 | 58 | 145 |
| 17 | 42 | 59 | 148 |
| 18 | 45 | 60 | 150 |
| 19 | 47 | 61 | 152 |
| 20 | 50 | 62 | 155 |
| 21 | 52 | 63 | 158 |
| 22 | 55 | 64 | 160 |
| 23 | 57 | 65 | 163 |
| 24 | 60 | 66 | 165 |
| 25 | 62 | 67 | 168 |
| 26 | 65 | 68 | 170 |
| 27 | 67 | 69 | 173 |
| 28 | 70 | 70 | 175 |
| 29 | 72 | 71 | 178 |
| 30 | 75 | 72 | 180 |
| 31 | 77 | 73 | 183 |
| 32 | 80 | 74 | 185 |
| 33 | 82 | 75 | 188 |
| 34 | 85 | 76 | 190 |
| 35 | 87 | 77 | 193 |
| 36 | 9 | 78 | 195 |
| 37 | 92 | 79 | 198 |
| 38 | 95 | 80 | 200 |
| 39 | 97 | 81 | 203 |
| 40 | 100 | 82 | 205 |
| 41 | 102 | 83 | 208 |
| 42 | 105 | 84 | 210 |
| 43 | 107 | 85 | 213 |
| 44 | 110 | 86 | 215 |
| 45 | 112 | 87 | 218 |
| 46 | 115 | 88 | 220 |
| 47 | 117 | 89 | 223 |
| 48 | 120 | 90 | 225 |
| 49 | 122 | 91 | 228 |
| 50 | 125 | 92 | 230 |

| Side 19½ | | 51 | 134 |
|---|---|---|---|
| Ft. Inch. | Ins. Cents. | 52 | 137 |
| | | 53 | 140 |
| | | 54 | 142 |
| | | 55 | 145 |
| 14 | 37 | 56 | 148 |
| 15 | 39 | 57 | 150 |
| 16 | 42 | 58 | 153 |
| 17 | 45 | 59 | 156 |
| 18 | 47 | 60 | 158 |
| 19 | 50 | 61 | 161 |
| 20 | 53 | 62 | 163 |
| 21 | 55 | 63 | 166 |
| 22 | 58 | 64 | 169 |
| 23 | 60 | 65 | 171 |
| 24 | 63 | 66 | 174 |
| 25 | 66 | 67 | 177 |
| 26 | 68 | 68 | 179 |
| 27 | 71 | 69 | 182 |
| 28 | 74 | 70 | 185 |
| 29 | 76 | 71 | 187 |
| 30 | 79 | 72 | 190 |
| 31 | 82 | 73 | 192 |
| 32 | 84 | 74 | 195 |
| 33 | 87 | 75 | 198 |
| 34 | 90 | 76 | 200 |
| 35 | 92 | 77 | 203 |
| 36 | 95 | 78 | 206 |
| 37 | 97 | 79 | 208 |
| 38 | 100 | 80 | 211 |
| 39 | 103 | 81 | 214 |
| 40 | 105 | 82 | 216 |
| 41 | 108 | 83 | 219 |
| 42 | 111 | 84 | 222 |
| 43 | 113 | 85 | 224 |
| 44 | 116 | 86 | 227 |
| 45 | 119 | 87 | 230 |
| 46 | 121 | 88 | 232 |
| 47 | 124 | 89 | 235 |
| 48 | 127 | 90 | 237 |
| 49 | 129 | 91 | 240 |
| 50 | 132 | 92 | 242 |

# OF THE WEIGHT AND DIMENSIONS OF BALLS.

### PROBLEM I.

*To find the Weight of an Iron Ball, from its Diameter.*

An iron ball of 4 inches diameter weighs 9lbs. and the weights being as the cubes of the diameters, it will be, as 64 (which is the cube of 4) is to 9 its weight, so is the cube of the diameter of any ball, to its weight. Or, take $\frac{9}{64}$ of the cube of the diameter, for the weight. Or, take $\frac{1}{8}$ of the cube of the diameter, and $\frac{1}{8}$ of that again, and add the two together, for the weight.

EXAMPLES.

1. The diameter of an iron shot being 6·7 inches, required its weight? Ans. 42·294lb.

2. What is the weight of an iron ball, whose diameter is 5·54 inches? Ans. 24lb. nearly.

### PROBLEM II.

*To find the Weight of a Leaden Ball.*

A leaden ball of 1 inch diameter weighs $\frac{3}{14}$ of a pound; therefore as the cube of 1 is to $\frac{3}{14}$, or as 14 is to 3, so is the cube of the diameter of the leaden ball, to its weight.—Or, take $\frac{3}{14}$ of the cube of the diameter, for the weight, nearly.

EXAMPLES.

1. Required the weight of a leaden ball of 6'6 inches diameter? Ans. 61·606lb.

2. What is the weight of a leaden ball of 5·30 inches diameter? Ans. 32lb. nearly.

### PROBLEM III.

*To find the Diameter of an Iron Ball.*

Multiply the weight by $7\frac{1}{9}$, and the cube root of the product will be the diameter.

EXAMPLE. What is the diameter of a 24lb. ball?
Ans. 5·54 inches.

PROBLEM IV.

*To find the Diameter of a Leaden Ball.*

Multiply the weight by 14, and divide the product by 3; then the cube root of the quotient will be the diameter.

EXAMPLE. What is the diameter of an 8lb leaden ball?
Ans. 3·343 inches.

## A TABLE OF SOLID MEASURE, OF ROUND TIMBER.

By the following Table the solid contents of any stick of round timber may be found at sight, from 6 inches to 40 inches in diameter, and from 7 feet to 91 feet in length. It rises 1 inch in diameter at a time, and one foot in length at a time. The left hand columns of each page, and the columns at the right hand of each double line, give the inches in diameter, and the other columns the contents, which are given in cubic feet and tenths of a foot. Over the top of these two columns is placed the length of the stick; and to find the contents of any stick, first find the length at the top, then the inches in diameter in the left hand column, and against this, to the right hand, will be found the contents sought for, in cubic feet and tenths of a foot. For example: to find the number of cubic feet, which a stick contains, that is 7 feet in length, and 10 inches in diameter—first find 7 feet at the top, then follow the left hand column down to 10; then against 10 to the right hand will be found 3 feet and 8 tenths of a foot.

| Side 20 Ins. | | 51 | 141 | Side 20½ Ins. | | 51 | 143 | Side 21 Ins. | | 51 | 156 | Side 21½ Ins. | | 51 | 163 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ft. long. | Cont. | 52 | 144 | Ft. long. | Cont. | 52 | 152 | Ft. long. | Cont. | 52 | 159 | Ft. long. | Cont. | 52 | 167 |
| | | 53 | 147 | | | 53 | 154 | | | 53 | 162 | | | 53 | 170 |
| | | 54 | 150 | | | 54 | 157 | | | 54 | 165 | | | 54 | 173 |
| | | 55 | 153 | | | 55 | 160 | | | 55 | 168 | | | 55 | 176 |
| 14 | 39 | 56 | 155 | 14 | 41 | 56 | 163 | 14 | 43 | 56 | 171 | 14 | 45 | 56 | 180 |
| 15 | 41 | 57 | 158 | 15 | 44 | 57 | 166 | 15 | 46 | 57 | 174 | 15 | 48 | 57 | 183 |
| 16 | 44 | 58 | 161 | 16 | 46 | 58 | 169 | 16 | 49 | 58 | 177 | 16 | 51 | 58 | 186 |
| 17 | 47 | 59 | 164 | 17 | 49 | 59 | 172 | 17 | 52 | 59 | 180 | 17 | 54 | 59 | 189 |
| 18 | 50 | 60 | 166 | 18 | 52 | 60 | 175 | 18 | 55 | 60 | 184 | 18 | 58 | 60 | 192 |
| 19 | 53 | 61 | 169 | 19 | 55 | 61 | 178 | 19 | 58 | 61 | 187 | 19 | 61 | 61 | 196 |
| 20 | 55 | 62 | 172 | 20 | 58 | 62 | 181 | 20 | 61 | 62 | 190 | 20 | 64 | 62 | 199 |
| 21 | 58 | 63 | 175 | 21 | 61 | 63 | 184 | 21 | 64 | 63 | 193 | 21 | 67 | 63 | 202 |
| 22 | 61 | 64 | 178 | 22 | 64 | 64 | 187 | 22 | 67 | 64 | 196 | 22 | 70 | 64 | 205 |
| 23 | 64 | 65 | 180 | 23 | 67 | 65 | 189 | 23 | 70 | 65 | 199 | 23 | 74 | 65 | 208 |
| 24 | 66 | 66 | 183 | 24 | 70 | 66 | 192 | 24 | 73 | 66 | 202 | 24 | 77 | 66 | 212 |
| 25 | 69 | 67 | 186 | 25 | 73 | 67 | 195 | 25 | 76 | 67 | 205 | 25 | 80 | 67 | 215 |
| 26 | 72 | 68 | 189 | 26 | 76 | 68 | 198 | 26 | 79 | 68 | 208 | 26 | 83 | 68 | 218 |
| 27 | 75 | 69 | 191 | 27 | 79 | 69 | 201 | 27 | 82 | 69 | 211 | 27 | 86 | 69 | 221 |
| 28 | 78 | 70 | 194 | 28 | 81 | 70 | 204 | 28 | 86 | 70 | 214 | 28 | 90 | 70 | 224 |
| 29 | 80 | 71 | 197 | 29 | 84 | 71 | 207 | 29 | 89 | 71 | 217 | 29 | 93 | 71 | 228 |
| 30 | 83 | 72 | 200 | 30 | 87 | 72 | 210 | 30 | 92 | 72 | 220 | 30 | 96 | 72 | 231 |
| 31 | 86 | 73 | 203 | 31 | 90 | 73 | 213 | 31 | 95 | 73 | 223 | 31 | 99 | 73 | 234 |
| 32 | 89 | 74 | 205 | 32 | 93 | 74 | 216 | 32 | 98 | 74 | 226 | 32 | 102 | 74 | 237 |
| 33 | 91 | 75 | 208 | 33 | 96 | 75 | 219 | 33 | 101 | 75 | 229 | 33 | 106 | 75 | 241 |
| 34 | 94 | 76 | 211 | 34 | 99 | 76 | 322 | 34 | 104 | 76 | 233 | 34 | 109 | 76 | 244 |
| 35 | 97 | 77 | 214 | 35 | 102 | 77 | 224 | 35 | 107 | 77 | 236 | 35 | 112 | 77 | 247 |
| 36 | 100 | 78 | 216 | 36 | 105 | 78 | 227 | 36 | 110 | 78 | 239 | 36 | 115 | 78 | 250 |
| 37 | 103 | 79 | 219 | 37 | 108 | 79 | 230 | 37 | 113 | 79 | 242 | 37 | 119 | 69 | 253 |
| 38 | 105 | 80 | 222 | 38 | 111 | 80 | 233 | 38 | 116 | 80 | 245 | 38 | 122 | 80 | 257 |
| 39 | 108 | 81 | 225 | 39 | 114 | 81 | 236 | 39 | 119 | 81 | 248 | 39 | 125 | 81 | 260 |
| 40 | 111 | 82 | 228 | 40 | 116 | 82 | 239 | 40 | 122 | 82 | 251 | 40 | 128 | 82 | 263 |
| 41 | 114 | 83 | 230 | 41 | 119 | 83 | 242 | 41 | 125 | 83 | 254 | 41 | 131 | 83 | 266 |
| 42 | 116 | 84 | 233 | 42 | 122 | 84 | 245 | 43 | 128 | 84 | 257 | 42 | 135 | 84 | 269 |
| 43 | 119 | 85 | 236 | 43 | 125 | 85 | 248 | 43 | 131 | 85 | 260 | 43 | 138 | 85 | 273 |
| 44 | 122 | 86 | 239 | 44 | 128 | 86 | 251 | 44 | 135 | 86 | 263 | 44 | 141 | 86 | 276 |
| 45 | 125 | 87 | 241 | 25 | 131 | 87 | 254 | 45 | 138 | 87 | 266 | 45 | 244 | 87 | 279 |
| 46 | 128 | 88 | 244 | 46 | 134 | 88 | 257 | 46 | 141 | 88 | 269 | 46 | 147 | 88 | 282 |
| 47 | 130 | 89 | 247 | 47 | 137 | 89 | 260 | 47 | 144 | 89 | 272 | 47 | 150 | 79 | 285 |
| 48 | 133 | 90 | 250 | 48 | 140 | 90 | 262 | 48 | 147 | 90 | 275 | 48 | 154 | 90 | 289 |
| 49 | 136 | 91 | 253 | 49 | 143 | 91 | 265 | 49 | 150 | 91 | 278 | 49 | 157 | 91 | 292 |
| 50 | 139 | 92 | 155 | 50 | 146 | 92 | 268 | 50 | 153 | 92 | 282 | 50 | 160 | 92 | 295 |

| Side 22 Ins. | | | | Side 22½ Ins. | | | | Side 23 Ins. | | | | Side 23½ Ins. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ft. long. | Cents. | | | Ft. long. | Cents. | | | Ft. long. | Cents. | | | Ft. long. | Cents. | | |
| | 51 | 52 | 53 | | 51 | 52 | 53 | | 51 | 52 | 53 | | 51 | 52 | 53 |
| | 171 | 175 | 178 | | 179 | 183 | 186 | | 187 | 191 | 194 | | 196 | 199 | 203 |
| | 54 | 55 | | | 54 | 55 | | | 54 | 55 | | | 54 | 55 | |
| | 181 | 185 | | | 190 | 193 | | | 198 | 202 | | | 207 | 211 | |
| 14 | 47 | 56 | 188 | 14 | 49 | 56 | 197 | 14 | 51 | 56 | 205 | 14 | 53 | 56 | 215 |
| 15 | 50 | 57 | 191 | 15 | 52 | 57 | 200 | 15 | 55 | 57 | 209 | 15 | 57 | 57 | 219 |
| 16 | 54 | 58 | 195 | 16 | 56 | 58 | 204 | 16 | 59 | 58 | 213 | 16 | 61 | 58 | 222 |
| 17 | 57 | 59 | 198 | 17 | 60 | 59 | 207 | 17 | 62 | 59 | 217 | 17 | 65 | 59 | 226 |
| 18 | 60 | 60 | 202 | 18 | 63 | 60 | 211 | 18 | 66 | 60 | 220 | 18 | 69 | 60 | 230 |
| 19 | 64 | 61 | 205 | 19 | 67 | 61 | 214 | 19 | 70 | 61 | 224 | 19 | 73 | 61 | 234 |
| 20 | 67 | 62 | 208 | 20 | 70 | 62 | 218 | 20 | 73 | 62 | 228 | 20 | 76 | 62 | 238 |
| 21 | 70 | 63 | 212 | 21 | 74 | 63 | 221 | 21 | 77 | 63 | 231 | 21 | 80 | 63 | 241 |
| 22 | 74 | 64 | 215 | 22 | 77 | 64 | 225 | 22 | 81 | 64 | 235 | 22 | 84 | 64 | 245 |
| 23 | 77 | 65 | 218 | 23 | 81 | 65 | 228 | 23 | 84 | 65 | 239 | 23 | 88 | 65 | 249 |
| 24 | 80 | 66 | 222 | 24 | 84 | 66 | 232 | 24 | 88 | 66 | 242 | 24 | 92 | 66 | 253 |
| 25 | 84 | 67 | 225 | 25 | 88 | 67 | 235 | 25 | 92 | 67 | 246 | 25 | 96 | 67 | 257 |
| 26 | 87 | 68 | 228 | 26 | 91 | 68 | 239 | 26 | 95 | 68 | 250 | 26 | 99 | 68 | 261 |
| 27 | 91 | 69 | 232 | 27 | 95 | 69 | 243 | 27 | 99 | 69 | 253 | 27 | 103 | 69 | 264 |
| 28 | 94 | 70 | 235 | 28 | 98 | 70 | 246 | 28 | 103 | 70 | 257 | 28 | 107 | 70 | 268 |
| 29 | 97 | 71 | 238 | 29 | 102 | 71 | 249 | 29 | 106 | 71 | 261 | 29 | 111 | 71 | 272 |
| 30 | 101 | 72 | 242 | 30 | 105 | 72 | 253 | 30 | 110 | 72 | 264 | 30 | 115 | 72 | 276 |
| 31 | 104 | 73 | 245 | 31 | 109 | 73 | 256 | 31 | 114 | 73 | 268 | 31 | 119 | 73 | 280 |
| 32 | 107 | 74 | 248 | 32 | 112 | 77 | 260 | 32 | 117 | 74 | 272 | 32 | 122 | 74 | 284 |
| 33 | 111 | 75 | 252 | 33 | 116 | 75 | 263 | 33 | 121 | 75 | 275 | 33 | 126 | 75 | 287 |
| 34 | 114 | 76 | 255 | 34 | 119 | 76 | 267 | 34 | 125 | 76 | 279 | 34 | 130 | 76 | 291 |
| 35 | 117 | 77 | 259 | 35 | 123 | 77 | 270 | 35 | 128 | 77 | 283 | 35 | 134 | 77 | 295 |
| 36 | 121 | 78 | 262 | 36 | 126 | 78 | 274 | 36 | 132 | 78 | 286 | 36 | 138 | 78 | 299 |
| 37 | 124 | 79 | 265 | 37 | 130 | 79 | 277 | 37 | 136 | 79 | 290 | 37 | 142 | 79 | 303 |
| 38 | 127 | 80 | 269 | 38 | 133 | 80 | 281 | 38 | 139 | 80 | 294 | 38 | 145 | 80 | 307 |
| 39 | 131 | 81 | 272 | 39 | 137 | 81 | 285 | 39 | 143 | 81 | 297 | 39 | 149 | 81 | 310 |
| 40 | 134 | 82 | 275 | 40 | 140 | 82 | 288 | 40 | 147 | 82 | 301 | 40 | 153 | 82 | 314 |
| 41 | 137 | 83 | 279 | 41 | 144 | 83 | 291 | 41 | 150 | 83 | 305 | 41 | 157 | 83 | 318 |
| 42 | 141 | 84 | 282 | 42 | 147 | 84 | 295 | 42 | 154 | 84 | 308 | 42 | 161 | 84 | 322 |
| 43 | 144 | 85 | 285 | 43 | 151 | 85 | 298 | 43 | 158 | 85 | 312 | 43 | 165 | 85 | 326 |
| 44 | 148 | 86 | 289 | 44 | 154 | 86 | 302 | 44 | 161 | 86 | 316 | 44 | 168 | 86 | 330 |
| 45 | 151 | 87 | 292 | 45 | 158 | 87 | 306 | 45 | 165 | 87 | 319 | 45 | 172 | 87 | 333 |
| 46 | 154 | 88 | 296 | 46 | 161 | 88 | 309 | 46 | 169 | 88 | 323 | 46 | 176 | 88 | 337 |
| 47 | 158 | 89 | 299 | 47 | 165 | 89 | 313 | 47 | 172 | 89 | 327 | 47 | 180 | 89 | 341 |
| 48 | 161 | 90 | 302 | 48 | 168 | 90 | 316 | 48 | 176 | 90 | 330 | 48 | 184 | 90 | 345 |
| 49 | 164 | 91 | 306 | 49 | 172 | 91 | 319 | 49 | 180 | 91 | 334 | 49 | 188 | 91 | 349 |
| 50 | 168 | 92 | 309 | 50 | 176 | 92 | 323 | 50 | 183 | 92 | 337 | 50 | 192 | 92 | 353 |

| Side 24 Ins. | | 51 | 204 |
|---|---|---|---|
| Ft. long. | Cents. | 52 | 208 |
| | | 53 | 212 |
| | | 54 | 216 |
| | | 55 | 220 |
| 14 | 56 | 56 | 224 |
| 15 | 60 | 57 | 228 |
| 16 | 64 | 58 | 232 |
| 17 | 68 | 59 | 236 |
| 18 | 72 | 60 | 240 |
| 19 | 76 | 61 | 244 |
| 20 | 80 | 62 | 248 |
| 21 | 84 | 63 | 252 |
| 22 | 88 | 64 | 256 |
| 23 | 92 | 65 | 260 |
| 24 | 96 | 66 | 264 |
| 25 | 100 | 67 | 268 |
| 26 | 104 | 68 | 272 |
| 27 | 108 | 69 | 276 |
| 28 | 112 | 70 | 280 |
| 29 | 116 | 71 | 284 |
| 30 | 120 | 72 | 288 |
| 31 | 124 | 73 | 292 |
| 32 | 128 | 74 | 296 |
| 33 | 132 | 75 | 300 |
| 34 | 136 | 76 | 304 |
| 35 | 140 | 77 | 308 |
| 36 | 144 | 78 | 312 |
| 37 | 148 | 79 | 316 |
| 38 | 152 | 80 | 320 |
| 39 | 156 | 81 | 324 |
| 40 | 160 | 82 | 328 |
| 41 | 164 | 83 | 332 |
| 42 | 168 | 84 | 336 |
| 43 | 172 | 85 | 340 |
| 44 | 176 | 86 | 344 |
| 45 | 180 | 87 | 348 |
| 46 | 184 | 88 | 352 |
| 47 | 188 | 89 | 356 |
| 48 | 192 | 90 | 360 |
| 49 | 196 | 91 | 364 |
| 50 | 200 | 92 | 368 |

| Side 24½ Ins. | | 51 | 212 |
|---|---|---|---|
| Ft. long. | Cents. | 52 | 317 |
| | | 53 | 221 |
| | | 54 | 225 |
| | | 55 | 229 |
| 14 | 58 | 56 | 233 |
| 15 | 62 | 57 | 237 |
| 16 | 66 | 58 | 242 |
| 17 | 71 | 59 | 246 |
| 18 | 75 | 60 | 250 |
| 19 | 79 | 61 | 254 |
| 20 | 83 | 62 | 258 |
| 21 | 87 | 63 | 262 |
| 22 | 91 | 64 | 267 |
| 23 | 96 | 65 | 271 |
| 24 | 100 | 66 | 275 |
| 25 | 104 | 67 | 279 |
| 26 | 108 | 68 | 283 |
| 27 | 112 | 69 | 287 |
| 28 | 116 | 70 | 292 |
| 29 | 121 | 71 | 296 |
| 30 | 125 | 72 | 300 |
| 31 | 129 | 73 | 304 |
| 32 | 133 | 74 | 308 |
| 33 | 137 | 75 | 313 |
| 34 | 141 | 76 | 317 |
| 35 | 146 | 77 | 321 |
| 36 | 150 | 78 | 325 |
| 37 | 154 | 79 | 329 |
| 38 | 158 | 80 | 333 |
| 39 | 162 | 81 | 337 |
| 40 | 166 | 82 | 342 |
| 41 | 171 | 83 | 346 |
| 42 | 175 | 84 | 350 |
| 43 | 179 | 85 | 354 |
| 44 | 183 | 86 | 358 |
| 45 | 187 | 87 | 362 |
| 46 | 192 | 88 | 367 |
| 47 | 196 | 89 | 371 |
| 48 | 200 | 90 | 375 |
| 49 | 204 | 91 | 379 |
| 50 | 208 | 92 | 383 |

| Side 25 Ins. | | 51 | 221 |
|---|---|---|---|
| Ft. long. | Cents. | 52 | 225 |
| | | 53 | 230 |
| | | 54 | 234 |
| | | 55 | 239 |
| 14 | 61 | 56 | 243 |
| 15 | 95 | 57 | 247 |
| 16 | 69 | 58 | 252 |
| 17 | 74 | 59 | 256 |
| 18 | 78 | 60 | 260 |
| 19 | 82 | 61 | 265 |
| 20 | 87 | 62 | 269 |
| 21 | 91 | 63 | 273 |
| 22 | 95 | 64 | 278 |
| 23 | 100 | 65 | 282 |
| 24 | 104 | 66 | 286 |
| 25 | 108 | 67 | 291 |
| 26 | 113 | 68 | 295 |
| 27 | 117 | 69 | 299 |
| 28 | 121 | 70 | 304 |
| 29 | 126 | 71 | 308 |
| 30 | 130 | 72 | 312 |
| 31 | 134 | 73 | 317 |
| 32 | 139 | 74 | 321 |
| 33 | 143 | 75 | 325 |
| 34 | 147 | 76 | 330 |
| 35 | 152 | 77 | 334 |
| 36 | 156 | 78 | 338 |
| 37 | 160 | 79 | 343 |
| 38 | 165 | 80 | 347 |
| 39 | 169 | 81 | 351 |
| 40 | 173 | 82 | 356 |
| 41 | 178 | 83 | 360 |
| 42 | 182 | 84 | 364 |
| 43 | 186 | 85 | 369 |
| 44 | 191 | 86 | 373 |
| 45 | 195 | 87 | 377 |
| 46 | 199 | 88 | 382 |
| 47 | 204 | 89 | 386 |
| 48 | 208 | 90 | 390 |
| 49 | 212 | 91 | 395 |
| 50 | 217 | 92 | 399 |

| Side 25½ Ins. | | 51 | 230 |
|---|---|---|---|
| Ft. long. | Cents. | 52 | 235 |
| | | 53 | 239 |
| | | 54 | 244 |
| | | 55 | 248 |
| 14 | 63 | 56 | 253 |
| 15 | 67 | 57 | 257 |
| 16 | 72 | 58 | 262 |
| 17 | 77 | 59 | 266 |
| 18 | 81 | 60 | 271 |
| 19 | 86 | 61 | 275 |
| 20 | 90 | 62 | 280 |
| 21 | 95 | 63 | 284 |
| 22 | 99 | 64 | 289 |
| 23 | 104 | 65 | 293 |
| 24 | 108 | 66 | 298 |
| 25 | 113 | 67 | 302 |
| 26 | 117 | 68 | 307 |
| 27 | 122 | 69 | 311 |
| 28 | 126 | 70 | 316 |
| 29 | 131 | 71 | 320 |
| 30 | 135 | 72 | 325 |
| 31 | 140 | 73 | 329 |
| 32 | 144 | 74 | 334 |
| 33 | 149 | 75 | 338 |
| 34 | 153 | 76 | 343 |
| 35 | 158 | 77 | 347 |
| 36 | 162 | 78 | 352 |
| 37 | 167 | 79 | 356 |
| 38 | 171 | 80 | 361 |
| 39 | 176 | 81 | 365 |
| 40 | 180 | 82 | 370 |
| 41 | 185 | 83 | 374 |
| 42 | 189 | 84 | 379 |
| 43 | 194 | 85 | 383 |
| 44 | 198 | 86 | 388 |
| 45 | 203 | 87 | 392 |
| 46 | 207 | 88 | 397 |
| 47 | 212 | 89 | 401 |
| 48 | 217 | 90 | 406 |
| 49 | 221 | 91 | 411 |
| 50 | 226 | 92 | 415 |

| Side 26 Ins. | | 51 | 238 | Side 26½ Ins. | | 51 | 246 | Side 27 Ins. | | 51 | 258 | Side 27½ Ins. | | 51 | 266 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length. | Cont. | 52 | 44 | Length. | Cont. | 52 | 53 | Length. | Cont. | 52 | 63 | Length. | Cont. | 52 | 72 |
| | | 53 | 49 | | | 53 | 59 | | | 53 | 68 | | | 53 | 78 |
| | | 54 | 53 | | | 54 | 63 | | | 54 | 73 | | | 54 | 83 |
| | | 55 | 58 | | | 55 | 68 | | | 55 | 78 | | | 55 | 89 |
| 14 | 05 | 56 | 63 | 14 | 68 | 56 | 73 | 14 | 71 | 56 | 83 | 14 | 78 | 56 | 94 |
| 15 | 70 | 57 | 67 | 15 | 73 | 57 | 78 | 15 | 76 | 57 | 88 | 15 | 7 | 57 | 99 |
| 16 | 75 | 58 | 72 | 16 | 78 | 58 | 83 | 16 | 81 | 58 | 93 | 16 | 8 | 58 | 304 |
| 17 | 80 | 59 | 77 | 17 | 83 | 59 | 88 | 17 | 86 | 59 | 98 | 17 | 8 | 59 | 10 |
| 18 | 84 | 60 | 81 | 18 | 88 | 60 | 93 | 18 | 91 | 60 | 304 | 18 | 94 | 60 | 15 |
| 19 | 89 | 61 | 86 | 19 | 93 | 61 | 97 | 19 | 96 | 61 | 09 | 19 | 100 | 61 | 20 |
| 20 | 94 | 62 | 91 | 20 | 97 | 62 | 302 | 20 | 101 | 62 | 14 | 20 | 05 | 62 | 25 |
| 21 | 98 | 63 | 96 | 21 | 102 | 63 | 07 | 21 | 06 | 63 | 19 | 21 | 10 | 63 | 30 |
| 22 | 103 | 64 | 300 | 22 | 07 | 64 | 12 | 22 | 11 | 64 | 24 | 22 | 15 | 64 | 36 |
| 23 | 08 | 65 | 05 | 23 | 12 | 65 | 17 | 23 | 16 | 65 | 29 | 23 | 21 | 65 | 41 |
| 24 | 13 | 66 | 10 | 24 | 17 | 66 | 22 | 24 | 21 | 66 | 34 | 24 | 26 | 66 | 46 |
| 25 | 17 | 67 | 14 | 25 | 22 | 67 | 27 | 25 | 26 | 67 | 39 | 25 | 31 | 67 | 52 |
| 26 | 22 | 68 | 19 | 26 | 27 | 68 | 31 | 26 | 32 | 68 | 44 | 26 | 36 | 68 | 57 |
| 27 | 27 | 69 | 24 | 27 | 31 | 69 | 36 | 27 | 37 | 69 | 49 | 27 | 42 | 69 | 62 |
| 28 | 32 | 70 | 28 | 28 | 36 | 70 | 41 | 28 | 42 | 70 | 54 | 28 | 47 | 70 | 67 |
| 29 | 36 | 71 | 33 | 29 | 41 | 71 | 46 | 29 | 47 | 71 | 59 | 29 | 52 | 71 | 73 |
| 30 | 41 | 72 | 38 | 30 | 46 | 72 | 51 | 30 | 52 | 72 | 64 | 30 | 57 | 72 | 78 |
| 31 | 45 | 73 | 43 | 31 | 51 | 73 | 56 | 31 | 57 | 73 | 70 | 31 | 63 | 73 | 83 |
| 32 | 50 | 74 | 47 | 32 | 56 | 74 | 61 | 32 | 62 | 74 | 75 | 32 | 68 | 74 | 88 |
| 33 | 55 | 75 | 52 | 33 | 61 | 75 | 66 | 33 | 67 | 75 | 80 | 33 | 73 | 75 | 94 |
| 34 | 59 | 76 | 57 | 34 | 66 | 76 | 70 | 34 | 72 | 76 | 85 | 34 | 78 | 76 | 99 |
| 35 | 64 | 77 | 61 | 35 | 70 | 77 | 75 | 35 | 77 | 77 | 90 | 35 | 84 | 77 | 404 |
| 36 | 69 | 78 | 66 | 36 | 75 | 78 | 80 | 36 | 82 | 78 | 95 | 36 | 89 | 78 | 09 |
| 37 | 73 | 79 | 71 | 37 | 80 | 79 | 85 | 37 | 87 | 79 | 400 | 37 | 94 | 79 | 15 |
| 38 | 78 | 80 | 75 | 38 | 85 | 80 | 90 | 38 | 92 | 80 | 05 | 38 | 99 | 80 | 21 |
| 39 | 83 | 81 | 80 | 39 | 90 | 81 | 95 | 39 | 97 | 81 | 10 | 39 | 205 | 81 | 26 |
| 40 | 88 | 82 | 85 | 40 | 95 | 82 | 400 | 40 | 202 | 82 | 15 | 40 | 10 | 82 | 30 |
| 41 | 92 | 83 | 89 | 41 | 200 | 83 | 05 | 41 | 08 | 83 | 20 | 41 | 15 | 83 | 35 |
| 42 | 97 | 84 | 94 | 42 | 05 | 84 | 09 | 42 | 13 | 84 | 25 | 42 | 20 | 84 | 40 |
| 43 | 202 | 85 | 99 | 43 | 09 | 85 | 14 | 43 | 18 | 85 | 30 | 43 | 25 | 85 | 46 |
| 44 | 06 | 86 | 403 | 44 | 14 | 86 | 19 | 44 | 23 | 86 | 35 | 44 | 31 | 86 | 51 |
| 45 | 11 | 87 | 08 | 45 | 19 | 87 | 24 | 45 | 28 | 87 | 40 | 45 | 36 | 87 | 57 |
| 46 | 16 | 88 | 13 | 46 | 24 | 88 | 29 | 46 | 33 | 88 | 45 | 46 | 41 | 88 | 62 |
| 47 | 21 | 89 | 18 | 47 | 29 | 89 | 34 | 47 | 38 | 89 | 50 | 47 | 47 | 89 | 67 |
| 48 | 25 | 90 | 22 | 48 | 34 | 90 | 39 | 48 | 43 | 90 | 55 | 48 | 52 | 90 | 72 |
| 49 | 30 | 91 | 27 | 49 | 39 | 91 | 44 | 49 | 48 | 91 | 60 | 49 | 57 | 91 | 78 |
| 50 | 34 | 92 | 32 | 50 | 44 | 92 | 49 | 50 | 53 | 92 | 65 | 50 | 62 | 92 | 82 |

| Side 28 | 51 | 277 | Side 28½ | 51 | 288 | Side 29 | 51 | 298 | Side 29½ | 51 | 308 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ft. long. | Ins. | | Ft. long. | Ins. | | Ft. long. | Ins. | | Ft. long. | Ins. | |
| | 52 | 83 | | 52 | 93 | | 52 | 304 | | 52 | 14 |
| | 53 | 89 | | 53 | 99 | | 53 | 09 | | 53 | 20 |
| | 54 | 94 | | 54 | 304 | | 54 | 15 | | 54 | 26 |
| | 55 | 99 | | 55 | 10 | | 55 | 21 | | 55 | 32 |
| 14 | 76 | 56 305 | 14 | 79 | 56 16 | 14 | 82 | 56 27 | 14 | 85 | 56 38 |
| 15 | 82 | 57 10 | 15 | 85 | 57 21 | 15 | 88 | 57 33 | 15 | 90 | 57 44 |
| 16 | 87 | 58 15 | 16 | 90 | 58 27 | 16 | 93 | 58 39 | 16 | 97 | 58 50 |
| 17 | 93 | 59 21 | 17 | 96 | 59 32 | 17 | 99 | 59 44 | 17 | 103 | 59 56 |
| 18 | 99 | 60 27 | 18 | 101 | 60 38 | 18 | 105 | 60 50 | 18 | 09 | 60 62 |
| 19 | 103 | 61 32 | 19 | 07 | 61 44 | 19 | 11 | 61 56 | 19 | 15 | 61 69 |
| 20 | 09 | 62 37 | 20 | 13 | 62 49 | 20 | 17 | 62 62 | 20 | 21 | 62 75 |
| 21 | 15 | 63 43 | 21 | 18 | 63 55 | 21 | 22 | 63 68 | 21 | 27 | 63 81 |
| 22 | 20 | 64 48 | 22 | 24 | 64 61 | 22 | 28 | 64 74 | 22 | 33 | 64 87 |
| 23 | 25 | 65 54 | 23 | 30 | 65 67 | 23 | 34 | 65 79 | 23 | 39 | 65 93 |
| 24 | 31 | 66 59 | 24 | 35 | 66 72 | 24 | 40 | 66 85 | 24 | 45 | 66 99 |
| 25 | 36 | 67 65 | 25 | 41 | 67 78 | 25 | 46 | 67 91 | 25 | 51 | 67 405 |
| 26 | 42 | 68 70 | 26 | 47 | 68 83 | 26 | 52 | 68 97 | 26 | 57 | 68 11 |
| 27 | 47 | 69 75 | 27 | 52 | 69 89 | 27 | 58 | 69 403 | 27 | 63 | 69 17 |
| 28 | 52 | 70 81 | 28 | 58 | 70 95 | 28 | 64 | 70 09 | 28 | 69 | 70 23 |
| 29 | 58 | 71 86 | 29 | 63 | 71 400 | 29 | 69 | 71 15 | 29 | 75 | 71 29 |
| 30 | 63 | 72 92 | 30 | 69 | 72 06 | 30 | 75 | 72 20 | 30 | 81 | 72 35 |
| 31 | 69 | 73 97 | 31 | 75 | 73 12 | 31 | 81 | 73 26 | 31 | 87 | 73 41 |
| 32 | 74 | 74 403 | 32 | 80 | 74 17 | 32 | 87 | 74 32 | 32 | 93 | 74 47 |
| 33 | 80 | 75 08 | 33 | 86 | 75 23 | 33 | 93 | 75 38 | 33 | 99 | 75 53 |
| 34 | 85 | 76 14 | 34 | 92 | 76 29 | 34 | 98 | 76 44 | 34 | 205 | 76 59 |
| 35 | 91 | 77 19 | 35 | 97 | 77 34 | 35 | 204 | 77 50 | 35 | 11 | 77 65 |
| 36 | 96 | 78 25 | 36 | 203 | 78 40 | 36 | 10 | 78 55 | 36 | 18 | 78 71 |
| 37 | 201 | 79 30 | 37 | 09 | 79 45 | 37 | 16 | 79 61 | 37 | 24 | 79 77 |
| 38 | 07 | 80 35 | 38 | 14 | 80 51 | 38 | 22 | 80 67 | 38 | 30 | 80 83 |
| 39 | 12 | 81 41 | 39 | 20 | 81 57 | 39 | 28 | 81 73 | 39 | 35 | 81 89 |
| 40 | 18 | 82 46 | 40 | 25 | 82 62 | 40 | 33 | 82 79 | 40 | 42 | 82 95 |
| 41 | 23 | 83 52 | 41 | 31 | 83 68 | 41 | 39 | 83 85 | 41 | 48 | 83 501 |
| 42 | 29 | 84 57 | 42 | 37 | 84 74 | 42 | 45 | 84 91 | 42 | 54 | 84 07 |
| 43 | 34 | 85 63 | 43 | 42 | 85 79 | 43 | 51 | 85 96 | 43 | 60 | 85 13 |
| 44 | 39 | 86 68 | 44 | 48 | 86 85 | 44 | 57 | 86 502 | 44 | 66 | 86 20 |
| 45 | 45 | 87 74 | 45 | 54 | 87 90 | 45 | 63 | 87 08 | 45 | 72 | 87 25 |
| 46 | 50 | 88 79 | 46 | 59 | 88 96 | 46 | 67 | 88 14 | 46 | 78 | 88 32 |
| 47 | 56 | 89 85 | 47 | 65 | 89 502 | 47 | 74 | 89 20 | 47 | 84 | 89 38 |
| 48 | 64 | 90 90 | 48 | 70 | 90 07 | 48 | 80 | 90 25 | 48 | 90 | 90 44 |
| 49 | 67 | 91 95 | 49 | 76 | 91 13 | 49 | 86 | 91 31 | 49 | 96 | 91 50 |
| 50 | 72 | 92 501 | 50 | 82 | 92 18 | 50 | 92 | 92 37 | 50 | 302 | 92 56 |

| Diameter, Ins. | 7 Ft. Long. Contents. | | Diameter, Ins. | 8 Ft. Long. Contents. | | Diameter, Ins. | 9 Ft. Long. Contents. | | Diameter, Ins. | 10 Ft. Long. Contents. | | Diameter, Ins. | 11 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 1 | 4 | 6 | 1 | 6 | 6 | 1 | 8 | 6 | 2 | 0 | 6 | 2 | 1 |
| 7 | 1 | 8 | 7 | 2 | 1 | 7 | 2 | 4 | 7 | 2 | 7 | 7 | 2 | 9 |
| 8 | 2 | 4 | 8 | 2 | 8 | 8 | 3 | 1 | 8 | 3 | 5 | 8 | 3 | 8 |
| 9 | 3 | 1 | 9 | 3 | 5 | 9 | 3 | 9 | 9 | 4 | 4 | 9 | 4 | 8 |
| 10 | 3 | 8 | 10 | 4 | 3 | 10 | 4 | 9 | 10 | 5 | 4 | 10 | 6 | 0 |
| 11 | 4 | 6 | 11 | 5 | 3 | 11 | 5 | 9 | 11 | 6 | 6 | 11 | 7 | 4 |
| 12 | 5 | 5 | 12 | 6 | 3 | 12 | 7 | 1 | 12 | 7 | 8 | 12 | 8 | 6 |
| 13 | 6 | 4 | 13 | 7 | 3 | 13 | 8 | 5 | 13 | 9 | 4 | 13 | 10 | 0 |
| 14 | 7 | 5 | 14 | 8 | 5 | 14 | 9 | 6 | 14 | 10 | 6 | 14 | 11 | 7 |
| 15 | 8 | 6 | 15 | 9 | 8 | 15 | 11 | 1 | 15 | 12 | 4 | 15 | 13 | 6 |
| 16 | 9 | 7 | 16 | 11 | 2 | 16 | 12 | 6 | 16 | 14 | 0 | 16 | 15 | 3 |
| 17 | 11 | 0 | 17 | 12 | 6 | 17 | 14 | 1 | 17 | 15 | 7 | 17 | 17 | 3 |
| 18 | 12 | 3 | 18 | 14 | 1 | 18 | 15 | 9 | 18 | 17 | 7 | 18 | 19 | 4 |
| 19 | 13 | 7 | 19 | 15 | 7 | 19 | 17 | 7 | 19 | 19 | 7 | 19 | 21 | 6 |
| 20 | 45 | 3 | 20 | 17 | 5 | 20 | 19 | 6 | 20 | 21 | 6 | 20 | 23 | 9 |
| 21 | 16 | 7 | 21 | 19 | 2 | 21 | 21 | 5 | 21 | 23 | 8 | 21 | 26 | 3 |
| 22 | 18 | 4 | 22 | 21 | 0 | 22 | 23 | 6 | 22 | 26 | 3 | 22 | 28 | 8 |
| 23 | 20 | 2 | 23 | 22 | 9 | 25 | 25 | 9 | 23 | 28 | 8 | 23 | 31 | 5 |
| 24 | 21 | 8 | 24 | 25 | 0 | 24 | 28 | 4 | 24 | 31 | 3 | 24 | 35 | 3 |
| 25 | 23 | 7 | 25 | 27 | 2 | 25 | 30 | 9 | 25 | 34 | 0 | 25 | 37 | 3 |
| 26 | 25 | 7 | 26 | 29 | 4 | 26 | 32 | 1 | 26 | 36 | 8 | 26 | 40 | 4 |
| 27 | 27 | 6 | 27 | 31 | 6 | 27 | 35 | 6 | 27 | 39 | 7 | 27 | 43 | 2 |
| 28 | 29 | 7 | 28 | 33 | 9 | 28 | 38 | 4 | 28 | 42 | 5 | 28 | 46 | 6 |
| 29 | 31 | 8 | 29 | 36 | 3 | 29 | 41 | 0 | 29 | 45 | 5 | 29 | 50 | 0 |
| 30 | 34 | 2 | 30 | 39 | 0 | 30 | 43 | 9 | 30 | 49 | 0 | 30 | 53 | 5 |
| 31 | 36 | 6 | 31 | 41 | 8 | 31 | 47 | 0 | 31 | 52 | 2 | 31 | 57 | 2 |
| 32 | 38 | 9 | 32 | 44 | 5 | 32 | 52 | 2 | 32 | 55 | 6 | 32 | 61 | 2 |
| 33 | 41 | 4 | 33 | 47 | 2 | 33 | 53 | 3 | 33 | 59 | 1 | 33 | 65 | 0 |
| 34 | 43 | 7 | 34 | 50 | 3 | 34 | 56 | 3 | 34 | 62 | 9 | 34 | 69 | 0 |
| 35 | 46 | 5 | 35 | 53 | 0 | 35 | 59 | 8 | 35 | 66 | 5 | 35 | 73 | 0 |
| 36 | 49 | 2 | 36 | 56 | 0 | 36 | 63 | 2 | 36 | 70 | 5 | 36 | 79 | 0 |
| 37 | 52 | 0 | 37 | 59 | 4 | 37 | 67 | 0 | 37 | 74 | 5 | 37 | 81 | 3 |
| 38 | 54 | 7 | 38 | 62 | 8 | 38 | 70 | 6 | 38 | 78 | 8 | 38 | 86 | 3 |
| 39 | 57 | 8 | 39 | 66 | 3 | 39 | 74 | 4 | 39 | 83 | 3 | 39 | 91 | 0 |
| 40 | 60 | 8 | 40 | 69 | 0 | 40 | 78 | 3 | 40 | 87 | 3 | 40 | 95 | 7 |

| Diameter, Ins. | 12 Ft. Long. Contents. | | Diameter, Ins. | 13 Ft. Long. Contents. | | Diameter, Ins. | 14 Ft. Long. Contents. | | Diameter, Ins. | 15 Ft. Long. Contents. | | Diameter, Ins. | 16 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 2 | 5 | 6 | 2 | 5 | 6 | 2 | 7 | 6 | 2 | 9 | 6 | 3 | 1 |
| 7 | 3 | 2 | 7 | 3 | 5 | 7 | 3 | 7 | 7 | 4 | 0 | 7 | 4 | 2 |
| 8 | 4 | 2 | 8 | 4 | 5 | 8 | 4 | 8 | 8 | 5 | 2 | 8 | 5 | 5 |
| 9 | 5 | 3 | 9 | 5 | 7 | 9 | 6 | 1 | 9 | 6 | 6 | 9 | 7 | 0 |
| 10 | 6 | 5 | 10 | 7 | 1 | 10 | 7 | 6 | 10 | 8 | 1 | 10 | 8 | 7 |
| 11 | 7 | 9 | 11 | 8 | 5 | 11 | 9 | 3 | 11 | 9 | 8 | 11 | 10 | 5 |
| 12 | 9 | 4 | 12 | 10 | 2 | 12 | 11 | 0 | 12 | 11 | 8 | 12 | 12 | 5 |
| 13 | 11 | 1 | 13 | 11 | 9 | 13 | 12 | 8 | 13 | 13 | 8 | 13 | 14 | 6 |
| 14 | 12 | 8 | 14 | 13 | 9 | 14 | 14 | 9 | 14 | 16 | 0 | 14 | 17 | 0 |
| 15 | 14 | 9 | 15 | 16 | 1 | 15 | 17 | 2 | 15 | 18 | 5 | 15 | 19 | 7 |
| 16 | 16 | 8 | 16 | 18 | 2 | 16 | 19 | 5 | 16 | 20 | 8 | 16 | 22 | 3 |
| 17 | 18 | 9 | 17 | 20 | 4 | 17 | 21 | 8 | 17 | 23 | 5 | 17 | 25 | 0 |
| 18 | 21 | 3 | 18 | 22 | 8 | 18 | 24 | 5 | 18 | 26 | 4 | 18 | 28 | 2 |
| 19 | 23 | 5 | 19 | 25 | 5 | 19 | 27 | 3 | 19 | 29 | 3 | 19 | 31 | 3 |
| 20 | 26 | 2 | 20 | 28 | 2 | 20 | 30 | 3 | 20 | 32 | 5 | 20 | 34 | 6 |
| 21 | 28 | 7 | 21 | 31 | 0 | 21 | 33 | 3 | 21 | 35 | 8 | 21 | 38 | 1 |
| 22 | 31 | 5 | 22 | 34 | 0 | 22 | 36 | 6 | 22 | 39 | 2 | 22 | 41 | 8 |
| 23 | 34 | 5 | 23 | 37 | 3 | 23 | 40 | 2 | 23 | 42 | 8 | 23 | 45 | 7 |
| 24 | 37 | 6 | 24 | 40 | 6 | 24 | 43 | 6 | 24 | 46 | 7 | 24 | 49 | 6 |
| 25 | 40 | 7 | 25 | 44 | 0 | 25 | 47 | 4 | 25 | 50 | 7 | 25 | 53 | 9 |
| 26 | 44 | 0 | 26 | 47 | 7 | 26 | 51 | 3 | 26 | 54 | 8 | 26 | 58 | 3 |
| 27 | 47 | 4 | 27 | 51 | 3 | 27 | 55 | 0 | 27 | 58 | 9 | 27 | 63 | 0 |
| 28 | 51 | 0 | 28 | 55 | 2 | 28 | 59 | 2 | 28 | 63 | 5 | 28 | 67 | 6 |
| 29 | 54 | 5 | 29 | 58 | 9 | 29 | 63 | 4 | 29 | 68 | 0 | 29 | 72 | 4 |
| 30 | 58 | 4 | 30 | 63 | 4 | 30 | 68 | 0 | 30 | 73 | 3 | 30 | 77 | 7 |
| 31 | 62 | 5 | 31 | 67 | 7 | 31 | 72 | 7 | 31 | 78 | 2 | 31 | 83 | 3 |
| 32 | 66 | 7 | 32 | 72 | 4 | 32 | 77 | 5 | 32 | 83 | 5 | 32 | 88 | 7 |
| 33 | 71 | 0 | 33 | 76 | 8 | 33 | 82 | 5 | 33 | 88 | 6 | 33 | 94 | 5 |
| 34 | 75 | 5 | 34 | 81 | 4 | 34 | 87 | 5 | 34 | 94 | 3 | 34 | 99 | 6 |
| 35 | 79 | 8 | 35 | 86 | 4 | 35 | 92 | 8 | 35 | 99 | 5 | 35 | 106 | 8 |
| 36 | 84 | 4 | 36 | 91 | 3 | 36 | 98 | 0 | 36 | 105 | 5 | 36 | 112 | 9 |
| 37 | 89 | 5 | 37 | 96 | 8 | 37 | 104 | 7 | 37 | 112 | 0 | 37 | 119 | 5 |
| 38 | 94 | 4 | 38 | 102 | 0 | 38 | 110 | 0 | 38 | 117 | 7 | 38 | 126 | 0 |
| 39 | 99 | 3 | 39 | 108 | 3 | 39 | 115 | 9 | 39 | 124 | 7 | 39 | 132 | 8 |
| 40 | 104 | 4 | 40 | 113 | 4 | 40 | 124 | 0 | 40 | 130 | 8 | 40 | 139 | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3 | 3 | 6 | 3 | 5 | 6 | 3 | 7 | 6 | 3 | | 6 | 4 | 1 |
| 7 | 4 | 5 | 7 | 4 | 8 | 7 | 5 | 1 | 7 | 5 | 3 | 7 | 5 | 6 |
| 8 | 5 | 9 | 8 | 6 | 3 | 8 | 6 | 0 | 8 | 7 | 0 | 8 | 7 | 3 |
| 9 | 7 | 5 | 9 | 8 | 0 | 9 | 8 | 4 | 9 | 8 | 8 | 9 | 9 | 4 |
| 10 | 9 | 3 | 10 | 9 | 8 | 10 | 10 | 4 | 10 | 11 | 0 | 10 | 11 | 5 |
| 11 | 11 | 2 | 11 | 11 | 9 | 11 | 12 | 6 | 11 | 13 | 3 | 11 | 13 | 9 |
| 12 | 13 | 4 | 12 | 14 | 2 | 12 | 15 | 0 | 12 | 15 | 8 | 12 | 16 | 6 |
| 13 | 17 | 7 | 13 | 16 | 1 | 13 | 17 | 6 | 13 | 18 | 5 | 13 | 19 | 5 |
| 14 | 18 | 5 | 14 | 19 | 3 | 14 | 20 | 7 | 14 | 21 | 4 | 14 | 22 | 5 |
| 15 | 21 | 1 | 15 | 22 | 3 | 15 | 23 | 6 | 15 | 24 | 7 | 15 | 26 | 2 |
| 16 | 23 | 8 | 16 | 25 | 2 | 16 | 26 | 7 | 16 | 28 | 2 | 16 | 29 | 5 |
| 17 | 26 | 8 | 17 | 28 | 3 | 17 | 30 | 0 | 17 | 31 | 6 | 17 | 33 | 3 |
| 18 | 30 | 1 | 18 | 31 | 9 | 18 | 33 | 6 | 18 | 35 | 4 | 18 | 37 | 2 |
| 19 | 33 | 5 | 19 | 35 | 4 | 19 | 37 | 5 | 19 | 39 | 4 | 19 | 41 | 5 |
| 20 | 37 | 2 | 20 | 39 | 2 | 20 | 41 | 5 | 20 | 43 | 7 | 20 | 46 | 0 |
| 21 | 40 | 9 | 21 | 43 | 1 | 21 | 45 | 6 | 21 | 48 | 4 | 21 | 50 | 4 |
| 22 | 44 | 7 | 22 | 47 | 4 | 22 | 50 | 2 | 22 | 52 | 7 | 22 | 55 | 2 |
| 23 | 49 | 1 | 23 | 51 | 8 | 23 | 54 | 8 | 23 | 57 | 7 | 23 | 60 | 8 |
| 24 | 53 | 5 | 24 | 56 | 1 | 24 | 59 | 5 | 24 | 62 | 9 | 24 | 66 | 2 |
| 25 | 57 | 7 | 25 | 61 | 4 | 25 | 64 | 8 | 25 | 68 | 5 | 26 | 71 | 8 |
| 26 | 62 | 6 | 26 | 66 | 4 | 26 | 70 | 2 | 26 | 74 | 0 | 26 | 77 | 6 |
| 27 | 67 | 5 | 27 | 71 | 5 | 27 | 75 | 4 | 27 | 79 | 5 | 27 | 83 | 5 |
| 28 | 72 | 6 | 28 | 77 | 2 | 28 | 81 | 3 | 28 | 85 | 6 | 28 | 90 | 0 |
| 29 | 77 | 7 | 29 | 82 | 4 | 29 | 87 | 2 | 29 | 91 | 5 | 29 | 96 | 3 |
| 30 | 83 | 5 | 30 | 88 | 4 | 30 | 93 | 5 | 30 | 98 | 5 | 30 | 103 | 4 |
| 31 | 89 | 4 | 31 | 94 | 5 | 31 | 99 | 5 | 31 | 105 | 3 | 31 | 111 | 0 |
| 32 | 95 | 5 | 32 | 101 | 0 | 32 | 106 | 8 | 32 | 112 | 4 | 32 | 118 | 0 |
| 33 | 101 | 5 | 33 | 107 | 3 | 33 | 113 | 4 | 33 | 119 | 5 | 33 | 125 | 4 |
| 34 | 107 | 6 | 34 | 113 | 8 | 34 | 120 | 0 | 34 | 126 | 7 | 34 | 133 | 0 |
| 35 | 114 | 0 | 35 | 120 | 5 | 35 | 127 | 2 | 35 | 135 | 0 | 35 | 141 | 0 |
| 36 | 120 | 8 | 36 | 127 | 5 | 36 | 135 | 0 | 36 | 142 | 2 | 36 | 149 | 0 |
| 37 | 127 | 6 | 37 | 135 | 3 | 37 | 143 | 0 | 37 | 150 | 9 | 37 | 157 | 6 |
| 38 | 134 | 8 | 38 | 142 | 6 | 38 | 150 | 8 | 38 | 159 | 0 | 38 | 166 | 5 |
| 39 | 142 | 0 | 39 | 150 | 5 | 39 | 159 | 0 | 39 | 167 | 9 | 39 | 176 | 0 |
| 40 | 149 | 5 | 40 | 158 | 0 | 40 | 167 | 0 | 40 | 176 | 0 | 40 | 185 | 0 |

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|---|---|---|---|---|---|---|---|---|---|
| 6 | 4 3 | 6 | 4 5 | 6 | 4 7 | 6 | 4 9 | 6 | 5 1 |
| 7 | 5 9 | 7 | 6 1 | 7 | 6 4 | 7 | 6 7 | 7 | 6 9 |
| 8 | 7 7 | 8 | 8 0 | 8 | 8 4 | 8 | 8 8 | 8 | 9 1 |
| 9 | 9 7 | 9 | 10 2 | 9 | 10 3 | 9 | 11 1 | 9 | 11 5 |
| 10 | 12 1 | 10 | 12 6 | 10 | 13 2 | 10 | 13 7 | 10 | 14 2 |
| 11 | 14 6 | 11 | 15 3 | 11 | 15 9 | 11 | 16 6 | 11 | 16 3 |
| 12 | 17 4 | 12 | 18 2 | 12 | 19 1 | 12 | 19 8 | 12 | 20 5 |
| 13 | 20 4 | 13 | 21 3 | 13 | 22 2 | 13 | 23 0 | 13 | 23 9 |
| 14 | 23 6 | 14 | 24 5 | 14 | 25 7 | 14 | 26 7 | 14 | 27 8 |
| 15 | 27 4 | 15 | 28 6 | 15 | 29 7 | 15 | 31 0 | 15 | 32 3 |
| 16 | 31 0 | 16 | 32 3 | 16 | 33 7 | 16 | 35 0 | 16 | 36 5 |
| 17 | 34 9 | 17 | 36 3 | 17 | 38 0 | 17 | 39 6 | 17 | 41 0 |
| 18 | 39 0 | 18 | 40 7 | 18 | 42 5 | 18 | 44 3 | 18 | 46 0 |
| 19 | 43 3 | 19 | 45 2 | 19 | 47 3 | 19 | 49 4 | 19 | 51 2 |
| 20 | 48 3 | 20 | 50 3 | 20 | 52 5 | 20 | 54 7 | 20 | 56 7 |
| 21 | 53 0 | 21 | 55 2 | 21 | 57 7 | 21 | 60 0 | 21 | 62 5 |
| 22 | 58 1 | 22 | 60 7 | 22 | 63 5 | 22 | 66 0 | 22 | 68 7 |
| 23 | 63 7 | 23 | 66 2 | 23 | 69 5 | 23 | 72 3 | 23 | 75 2 |
| 24 | 69 4 | 24 | 72 3 | 24 | 75 4 | 24 | 78 6 | 24 | 81 9 |
| 25 | 75 3 | 25 | 78 5 | 25 | 82 3 | 25 | 85 7 | 25 | 88 5 |
| 26 | 81 5 | 26 | 85 3 | 26 | 88 7 | 26 | 93 5 | 26 | 96 0 |
| 27 | 87 7 | 27 | 91 5 | 27 | 96 0 | 27 | 99 3 | 27 | 103 4 |
| 28 | 94 5 | 28 | 98 5 | 28 | 103 2 | 28 | 107 3 | 28 | 111 3 |
| 29 | 101 0 | 29 | 105 6 | 29 | 110 7 | 29 | 114 8 | 29 | 119 5 |
| 30 | 108 8 | 30 | 113 5 | 30 | 118 6 | 30 | 123 3 | 30 | 128 0 |
| 31 | 116 0 | 31 | 121 4 | 31 | 126 8 | 31 | 131 5 | 3. | 137 0 |
| 32 | 124 0 | 32 | 129 5 | 32 | 135 5 | 42 | 140 6 | 32 | 145 5 |
| 33 | 131 5 | 33 | 138 0 | 33 | 144 0 | 33 | 149 0 | 33 | 155 0 |
| 34 | 139 4 | 34 | 145 7 | 34 | 152 5 | 34 | 158 6 | 34 | 164 0 |
| 35 | 147 7 | 35 | 154 7 | 35 | 161 5 | 35 | 167 5 | 35 | 174 0 |
| 36 | 156 5 | 36 | 163 5 | 36 | 171 0 | 36 | 178 0 | 36 | 185 0 |
| 37 | 165 5 | 38 | 173 5 | 36 | 181 5 | 37 | 188 0 | 37 | 195 5 |
| 38 | 174 5 | 38 | 183 0 | 38 | 191 0 | 38 | 198 0 | 38 | 206 0 |
| 39 | 184 4 | 39 | 192 5 | 39 | 202 0 | 39 | 208 5 | 39 | 217 0 |
| 40 | 193 5 | 40 | 204 0 | 40 | 213 2 | 40 | 218 5 | 40 | 228 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 5 | 5 | 6 | 5 | 5 | 6 | 5 | 7 | 6 | 5 | 9 | 6 | 6 | 1 |
| 7 | 7 | 2 | 7 | 7 | 5 | 7 | 7 | 8 | 7 | 8 | 0 | 7 | 8 | 3 |
| 8 | 9 | 4 | 8 | 9 | 7 | 8 | 10 | 1 | 8 | 10 | 3 | 8 | 10 | 8 |
| 9 | 11 | 9 | 9 | 12 | 4 | 9 | 12 | 8 | 9 | 13 | 1 | 9 | 13 | 7 |
| 10 | 14 | 8 | 10 | 15 | 4 | 10 | 15 | 9 | 10 | 16 | 4 | 10 | 17 | 1 |
| 11 | 17 | 9 | 11 | 18 | 6 | 11 | 19 | 2 | 11 | 19 | 8 | 11 | 20 | 6 |
| 12 | 21 | 3 | 12 | 22 | 1 | 12 | 23 | [illegible] | 12 | 23 | 6 | 12 | 24 | 4 |
| 13 | 24 | 9 | 13 | 25 | 8 | 13 | 26 | 7 | 13 | 27 | 7 | 13 | 28 | 6 |
| 14 | 28 | 9 | 14 | 30 | 1 | 14 | 31 | 2 | 14 | 32 | 1 | 14 | 33 | 3 |
| 15 | 33 | 5 | 15 | 34 | 7 | 15 | 36 | 1 | 15 | 37 | 3 | 15 | 38 | 5 |
| 16 | 37 | 9 | 16 | 39 | 3 | 16 | 40 | 7 | 16 | 42 | [illegible] | 16 | 43 | 4 |
| 17 | 42 | 6 | 17 | 44 | 2 | 17 | 45 | 6 | 17 | 47 | 2 | 17 | 48 | 6 |
| 18 | 47 | 8 | 18 | 49 | 7 | 18 | 51 | 3 | 18 | 52 | 7 | 18 | 54 | 6 |
| 19 | 53 | 5 | 19 | 55 | 1 | 19 | 57 | 0 | 19 | 58 | 8 | 19 | 61 | 1 |
| 20 | 59 | 2 | 20 | 61 | 3 | 20 | 63 | 5 | 20 | 65 | 5 | 20 | 67 | 7 |
| 21 | 65 | 0 | 21 | 67 | 2 | 21 | 69 | 7 | 21 | 72 | 0 | 21 | 75 | 5 |
| 22 | 71 | 5 | 22 | 74 | 0 | 22 | 76 | 5 | 22 | 79 | 0 | 22 | 82 | 0 |
| 23 | 78 | 5 | 23 | 81 | 0 | 23 | 83 | 7 | 23 | 86 | 5 | 23 | 89 | 5 |
| 24 | 85 | 3 | 24 | 88 | [illegible] | 24 | 91 | 2 | 24 | 94 | 2 | 24 | 97 | 5 |
| 25 | 92 | 5 | 25 | 95 | 6 | 25 | 99 | 0 | 25 | 102 | 7 | 25 | 106 | 0 |
| 26 | 99 | 7 | 26 | 103 | 5 | 26 | 107 | 5 | 26 | 111 | 2 | 26 | 114 | 7 |
| 27 | 107 | 7 | 27 | 111 | 7 | 27 | 115 | 5 | 27 | 119 | 4 | 27 | 123 | 3 |
| 28 | 116 | 0 | 28 | 120 | 0 | 28 | 124 | 7 | 28 | 128 | 8 | 28 | 132 | 7 |
| 29 | 124 | 2 | 29 | 128 | 7 | 29 | 133 | 0 | 29 | 138 | 0 | 29 | 142 | 0 |
| 30 | 133 | 2 | 30 | 136 | 0 | 30 | 143 | 1 | 30 | 148 | 0 | 30 | 152 | 4 |
| 31 | 142 | 3 | 31 | 147 | 5 | 31 | 152 | 7 | 31 | 158 | 3 | 31 | 163 | 0 |
| 32 | 152 | 1 | 32 | 157 | 3 | 32 | 163 | 0 | 32 | 169 | 0 | 32 | 174 | 0 |
| 33 | 161 | 8 | 33 | 167 | 0 | 33 | 173 | 0 | 33 | 179 | 7 | 33 | 185 | 4 |
| 34 | 171 | 5 | 34 | 178 | 0 | 34 | 184 | 0 | 34 | 190 | 5 | 34 | 196 | 0 |
| 35 | 182 | 0 | 35 | 188 | 7 | 35 | 194 | 7 | 35 | 202 | 5 | 35 | 208 | 0 |
| 36 | 192 | 5 | 36 | 199 | 0 | 36 | 206 | 0 | 36 | 213 | 0 | 36 | 218 | 5 |
| 37 | 206 | 0 | 37 | 211 | 0 | 37 | 217 | 5 | 37 | 225 | 0 | 37 | 232 | 5 |
| 38 | 214 | 1 | 38 | 222 | 1 | 38 | 228 | 5 | 38 | 236 | 1 | 38 | 244 | 0 |
| 39 | 226 | 3 | 39 | 234 | 0 | 39 | 242 | 0 | 39 | 251 | 0 | 39 | 258 | 0 |
| 40 | 237 | 5 | 40 | 245 | 3 | 40 | 254 | 5 | 40 | 263 | 7 | 40 | 272 | 0 |

| 32 Ft. Long. | | | 33 Ft. Long. | | | 34 Ft. Long. | | | 35 Ft. Long. | | | 36 Ft. Long. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | |
| 6 | 6 | 3 | 6 | 6 | 5 | 6 | 6 | 7 | 6 | 6 | 9 | 6 | 7 | 1 |
| 7 | 8 | 6 | 7 | 8 | 8 | 7 | 9 | 1 | 7 | 9 | 4 | 7 | 9 | 6 |
| 8 | 11 | 1 | 8 | 11 | 5 | 8 | 11 | 9 | 8 | 12 | 3 | 8 | 12 | 6 |
| 9 | 14 | 2 | 9 | 14 | 6 | 9 | 15 | 1 | 9 | 15 | 5 | 9 | 15 | 9 |
| 10 | 17 | 6 | 10 | 18 | 2 | 10 | 18 | 7 | 10 | 19 | 3 | 10 | 19 | 7 |
| 11 | 21 | 2 | 11 | 21 | 7 | 11 | 22 | 5 | 11 | 23 | 2 | 11 | 23 | 7 |
| 12 | 25 | 4 | 12 | 26 | 1 | 12 | 26 | 7 | 12 | 27 | 7 | 12 | 28 | 4 |
| 13 | 29 | 5 | 13 | 30 | 6 | 13 | 31 | 4 | 13 | 32 | 3 | 13 | 33 | 3 |
| 14 | 34 | 3 | 14 | 35 | 4 | 14 | 36 | 5 | 14 | 37 | 6 | 14 | 38 | 7 |
| 15 | 39 | 7 | 15 | 41 | 1 | 15 | 42 | 2 | 15 | 43 | 3 | 15 | 44 | 5 |
| 16 | 45 | 0 | 16 | 46 | 3 | 16 | 47 | 7 | 16 | 49 | 2 | 16 | 50 | 4 |
| 17 | 50 | 5 | 17 | 52 | 0 | 17 | 53 | 4 | 17 | 55 | 2 | 17 | 56 | 5 |
| 18 | 56 | 5 | 18 | 58 | 3 | 18 | 60 | 1 | 18 | 62 | 0 | 18 | 63 | 6 |
| 19 | 63 | 0 | 19 | 65 | 0 | 19 | 67 | 0 | 19 | 69 | 0 | 19 | 70 | 9 |
| 20 | 70 | 2 | 20 | 72 | 2 | 20 | 74 | 4 | 20 | 76 | 7 | 20 | 79 | 0 |
| 21 | 76 | 7 | 21 | 79 | 5 | 21 | 81 | 7 | 21 | 84 | 4 | 21 | 86 | 5 |
| 22 | 84 | 5 | 22 | 87 | 2 | 22 | 89 | 5 | 22 | 92 | 5 | 22 | 95 | 4 |
| 23 | 92 | 4 | 23 | 95 | 5 | 23 | 98 | 3 | 23 | 101 | 2 | 23 | 104 | 5 |
| 24 | 100 | 8 | 24 | 104 | 0 | 24 | 107 | 0 | 24 | 10 | 5 | 24 | 13 | 5 |
| 25 | 09 | 5 | 25 | 13 | 0 | 25 | 15 | 7 | 25 | 19 | 5 | 25 | 23 | 0 |
| 26 | 18 | 5 | 26 | 22 | 0 | 26 | 25 | 8 | 26 | 29 | 5 | 26 | 33 | 0 |
| 27 | 27 | 5 | 27 | 31 | 5 | 27 | 35 | 2 | 27 | 39 | 5 | 27 | 42 | 5 |
| 28 | 37 | 5 | 28 | 41 | 5 | 28 | 45 | 5 | 28 | 50 | 3 | 28 | 54 | 4 |
| 29 | 46 | 4 | 29 | 51 | 6 | 29 | 55 | 5 | 29 | 61 | 0 | 29 | 65 | 0 |
| 30 | 57 | 0 | 30 | 62 | 0 | 30 | 67 | 0 | 30 | 72 | 5 | 30 | 77 | 5 |
| 31 | 69 | 0 | 31 | 74 | 0 | 31 | 79 | 0 | 31 | 82 | 4 | 31 | 90 | 0 |
| 32 | 80 | 0 | 32 | 85 | 5 | 32 | 91 | 0 | 32 | 97 | 0 | 32 | 202 | 0 |
| 33 | 91 | 2 | 33 | 97 | 0 | 33 | 202 | 5 | 33 | 208 | 0 | 33 | 14 | 0 |
| 34 | 202 | 5 | 34 | 208 | 2 | 34 | 14 | 3 | 34 | 20 | 0 | 34 | 27 | 0 |
| 35 | 14 | 0 | 35 | 20 | 5 | 35 | 27 | 0 | 35 | 34 | 0 | 35 | 40 | 0 |
| 36 | 26 | 5 | 36 | 33 | 5 | 36 | 40 | 0 | 36 | 47 | 0 | 36 | 55 | 0 |
| 37 | 40 | 0 | 37 | 47 | 5 | 27 | 54 | 3 | 37 | 62 | 5 | 37 | 69 | 5 |
| 38 | 53 | 5 | 38 | 61 | 5 | 38 | 68 | 0 | 38 | 76 | 4 | 38 | 84 | 0 |
| 39 | 67 | 0 | 39 | 75 | 0 | 39 | 83 | 2 | 39 | 92 | 5 | 39 | 300 | 0 |
| 40 | 80 | 0 | 40 | 88 | 5 | 40 | 97 | 3 | 40 | 306 | 4 | 40 | 13 | 2 |

| Diameter, Ins. | 37 Ft. Long. Contents. | | Diameter, Ins. | 38 Ft. Long. Contents. | | Diameter, Ins. | 39 Ft. Long. Contents. | | Diameter, Ins. | 40 Ft. Long. Contents. | | Diameter, Ins. | 41 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 7 | 3 | 6 | 7 | 4 | 6 | 7 | 7 | 6 | 7 | 8 | 6 | 8 | 0 |
| 7 | 9 | 9 | 7 | 10 | 2 | 7 | 10 | 4 | 7 | 10 | 5 | 7 | 10 | 5 |
| 8 | 12 | 9 | 8 | 13 | 3 | 8 | 13 | 7 | 8 | 14 | 0 | 8 | 14 | 3 |
| 9 | 16 | 3 | 9 | 16 | 8 | 9 | 17 | 3 | 9 | 17 | 7 | 9 | 18 | 1 |
| 10 | 20 | 3 | 10 | 20 | 7 | 10 | 21 | 6 | 10 | 21 | 7 | 10 | 22 | 3 |
| 11 | 24 | 4 | 11 | 25 | 2 | 11 | 25 | 7 | 11 | 26 | 4 | 11 | 28 | 7 |
| 12 | 29 | 2 | 12 | 29 | 9 | 12 | 30 | 8 | 12 | 31 | 7 | 12 | 32 | 2 |
| 13 | 34 | 0 | 13 | 35 | 0 | 13 | 36 | 1 | 13 | 36 | 8 | 13 | 37 | 7 |
| 14 | 39 | 6 | 14 | 40 | 7 | 14 | 41 | 7 | 14 | 42 | 7 | 14 | 43 | 5 |
| 15 | 45 | 8 | 15 | 47 | 0 | 15 | 48 | 4 | 15 | 49 | 5 | 15 | 50 | 6 |
| 16 | 51 | 7 | 16 | 53 | 3 | 16 | 54 | 5 | 16 | 55 | 7 | 16 | 57 | 0 |
| 17 | 58 | 2 | 17 | 59 | 7 | 17 | 62 | 5 | 17 | 62 | 9 | 17 | 64 | 2 |
| 18 | 65 | 4 | 18 | 67 | 0 | 18 | 69 | 0 | 18 | 70 | 5 | 18 | 74 | 3 |
| 19 | 72 | 8 | 19 | 74 | 7 | 19 | 76 | 7 | 19 | 78 | 7 | 19 | 80 | 4 |
| 20 | 81 | 0 | 20 | 83 | 3 | 20 | 85 | 5 | 20 | 87 | 5 | 20 | 89 | 0 |
| 21 | 89 | 8 | 21 | 91 | 3 | 21 | 93 | 7 | 21 | 96 | 0 | 21 | 98 | 4 |
| 22 | 97 | 7 | 22 | 100 | 5 | 22 | 103 | 2 | 22 | 106 | 0 | 22 | 108 | 6 |
| 23 | 107 | 3 | 23 | 10 | 0 | 23 | 13 | 0 | 23 | 15 | 5 | 23 | 19 | 5 |
| 24 | 16 | 6 | 24 | 19 | 3 | 24 | 23 | 0 | 24 | 26 | 0 | 24 | 29 | 0 |
| 25 | 27 | 0 | 25 | 30 | 0 | 25 | 33 | 3 | 25 | 37 | 3 | 25 | 40 | 4 |
| 26 | 37 | 3 | 26 | 41 | 5 | 26 | 44 | 4 | 26 | 48 | 0 | 26 | 51 | 5 |
| 27 | 47 | 3 | 27 | 51 | 0 | 27 | 55 | 5 | 27 | 59 | 5 | 27 | 63 | 0 |
| 28 | 59 | 0 | 28 | 63 | 0 | 28 | 67 | 0 | 28 | 72 | 0 | 28 | 75 | 2 |
| 29 | 70 | 7 | 29 | 74 | 5 | 29 | 80 | 0 | 29 | 82 | 0 | 29 | 88 | 0 |
| 30 | 83 | 0 | 30 | 87 | 5 | 30 | 92 | 5 | 30 | 97 | 0 | 30 | 202 | 0 |
| 31 | 95 | 1 | 31 | 200 | 5 | 31 | 205 | 0 | 31 | 211 | 0 | 31 | 14 | 5 |
| 32 | 207 | 2 | 32 | 12 | 4 | 32 | 18 | 0 | 32 | 24 | 0 | 32 | 28 | 0 |
| 33 | 21 | 0 | 33 | 26 | 5 | 33 | 32 | 5 | 33 | 38 | 2 | 33 | 43 | 5 |
| 34 | 34 | 0 | 34 | 39 | 0 | 34 | 46 | 0 | 34 | 53 | 0 | 34 | 58 | 0 |
| 35 | 47 | 0 | 35 | 54 | 0 | 35 | 62 | 0 | 35 | 68 | 0 | 35 | 74 | 0 |
| 36 | 62 | 5 | 36 | 67 | 5 | 36 | 76 | 0 | 36 | 83 | 0 | 36 | 89 | 0 |
| 37 | 76 | 5 | 37 | 85 | 0 | 37 | 93 | 5 | 37 | 300 | 0 | 37 | 307 | 0 |
| 38 | 92 | 5 | 38 | 300 | 0 | 38 | 309 | 0 | 38 | 16 | 5 | 38 | 24 | 0 |
| 39 | 309 | 0 | 39 | 16 | 5 | 39 | 26 | 2 | 39 | 34 | 0 | 39 | 41 | 2 |
| 40 | 25 | 0 | 40 | 33 | 0 | 40 | 41 | 4 | 40 | 49 | 5 | 40 | 59 | 0 |

| Diameter, Ins. | 42 Ft. Long. Contents. | | Diameter, Ins. | 43 Ft. Long. Contents. | | Diameter, Ins. | 44 Ft. Long. Contents. | | Diameter, Ins. | 45 Ft. Long. Contents. | | Diameter, Ins. | 46 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 8 | 2 | 6 | 8 | 4 | 6 | 8 | 7 | 6 | 8 | 8 | 6 | 9 | 0 |
| 7 | 11 | 3 | 7 | 11 | 5 | 7 | 11 | 7 | 7 | 12 | 0 | 7 | 12 | 3 |
| 8 | 14 | 7 | 8 | 15 | 1 | 8 | 15 | 4 | 8 | 15 | 7 | 8 | 16 | 1 |
| 9 | 19 | 5 | 9 | 19 | 1 | 9 | 19 | 4 | 9 | 19 | 8 | 9 | 20 | 4 |
| 10 | 22 | 9 | 10 | 23 | 5 | 10 | 24 | 0 | 10 | 24 | 5 | 10 | 25 | 3 |
| 11 | 27 | 7 | 11 | 28 | 4 | 11 | 29 | 2 | 11 | 29 | 6 | 11 | 30 | 5 |
| 12 | 33 | 0 | 12 | 33 | 9 | 12 | 34 | 7 | 12 | 35 | 4 | 12 | 36 | 4 |
| 13 | 38 | 7 | 13 | 39 | 7 | 13 | 40 | 5 | 13 | 41 | 4 | 13 | 42 | 5 |
| 14 | 44 | 7 | 14 | 45 | 9 | 14 | 46 | 9 | 14 | 48 | 0 | 14 | 49 | 4 |
| 15 | 51 | 7 | 15 | 53 | 3 | 15 | 52 | 2 | 15 | 55 | 5 | 15 | 57 | 0 |
| 16 | 58 | 5 | 16 | 60 | 4 | 16 | 61 | 5 | 16 | 62 | 8 | 16 | 64 | 6 |
| 17 | 66 | 0 | 17 | 67 | 7 | 17 | 69 | 4 | 17 | 70 | 7 | 17 | 72 | 7 |
| 18 | 74 | 2 | 18 | 76 | 0 | 18 | 77 | 6 | 18 | 79 | 5 | 18 | 81 | 5 |
| 19 | 82 | 5 | 19 | 84 | 6 | 19 | 86 | 5 | 19 | 88 | 4 | 19 | 90 | 8 |
| 20 | 91 | 5 | 20 | 94 | 5 | 20 | 96 | 3 | 20 | 98 | 5 | 20 | 100 | 5 |
| 21 | 100 | 8 | 21 | 103 | 4 | 21 | 105 | 5 | 21 | 108 | 3 | 21 | 10 | 5 |
| 22 | 11 | 0 | 22 | 13 | 5 | 22 | 16 | 0 | 22 | 18 | 4 | 22 | 21 | 5 |
| 23 | 21 | 3 | 23 | 24 | 5 | 23 | 27 | 3 | 23 | 29 | 5 | 23 | 33 | 0 |
| 24 | 32 | 0 | 24 | 35 | 0 | 24 | 38 | 7 | 24 | 41 | 5 | 24 | 44 | 5 |
| 25 | 43 | 5 | 25 | 47 | 3 | 25 | 50 | 5 | 25 | 53 | 7 | 25 | 57 | 0 |
| 26 | 55 | 0 | 26 | 59 | 0 | 26 | 62 | 7 | 26 | 66 | 5 | 26 | 70 | 5 |
| 27 | 67 | 0 | 27 | 71 | 0 | 27 | 75 | 0 | 27 | 79 | 0 | 27 | 83 | 0 |
| 28 | 80 | 2 | 28 | 84 | 7 | 28 | 88 | 5 | 28 | 93 | 0 | 28 | 97 | 0 |
| 29 | 92 | 8 | 29 | 97 | 0 | 29 | 201 | 5 | 29 | 213 | 0 | 29 | 211 | 0 |
| 30 | 206 | 5 | 30 | 211 | 5 | 30 | 15 | 0 | 30 | 21 | 0 | 30 | 25 | 0 |
| 31 | 20 | 0 | 31 | 25 | 2 | 31 | 21 | 0 | 31 | 36 | 0 | 31 | 42 | 0 |
| 32 | 34 | 5 | 32 | 41 | 0 | 32 | 45 | 4 | 32 | 52 | 5 | 32 | 57 | 5 |
| 33 | 49 | 0 | 33 | 56 | 1 | 33 | 62 | 0 | 33 | 67 | 5 | 33 | 73 | 0 |
| 34 | 64 | 0 | 34 | 71 | 5 | 34 | 76 | 5 | 34 | 83 | 5 | 34 | 89 | 0 |
| 35 | 82 | 1 | 35 | 87 | 0 | 35 | 94 | 0 | 35 | 301 | 5 | 35 | 307 | 5 |
| 36 | 96 | 0 | 36 | 304 | 0 | 36 | 310 | 3 | 36 | 17 | 5 | 36 | 25 | 0 |
| 37 | 314 | 5 | 37 | 22 | 7 | 37 | 28 | 0 | 37 | 36 | 5 | 37 | 44 | 0 |
| 38 | 32 | 1 | 38 | 37 | 5 | 38 | 45 | 0 | 38 | 55 | 0 | 38 | 63 | 2 |
| 39 | 49 | 0 | 39 | 57 | 1 | 39 | 66 | 4 | 39 | 75 | 0 | 38 | 84 | 0 |
| 40 | 67 | 3 | 40 | 77 | 0 | 40 | 85 | 2 | 40 | 94 | 0 | 40 | 403 | 1 |

| 47 Ft. Long. | | | 48 Ft. Long. | | | 49 Ft. Long. | | | 50 Ft. Long. | | | 51 Ft. Long. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | | Diameter, Ins. | Contents. | |
| 6 | 9 | 2 | 6 | 9 | 4 | 6 | 9 | 6 | 6 | 9 | 3 | 6 | 9 | 9 |
| 7 | 12 | 6 | 7 | 12 | 8 | 7 | 13 | 1 | 7 | 13 | 4 | 7 | 13 | 7 |
| 8 | 16 | 4 | 8 | 16 | 7 | 8 | 17 | 1 | 8 | 17 | 5 | 8 | 17 | 8 |
| 9 | 20 | 7 | 9 | 21 | 1 | 9 | 21 | 6 | 9 | 22 | 0 | 9 | 22 | 5 |
| 10 | 25 | 7 | 10 | 26 | 3 | 10 | 26 | 7 | 10 | 27 | 3 | 10 | 27 | 8 |
| 11 | 31 | 0 | 11 | 31 | 7 | 11 | 32 | 3 | 11 | 32 | 9 | 11 | 33 | 7 |
| 12 | 37 | 0 | 12 | 37 | 7 | 12 | 38 | 5 | 12 | 39 | 3 | 12 | 40 | 1 |
| 13 | 43 | 3 | 13 | 44 | 0 | 13 | 45 | 0 | 13 | 45 | 9 | 13 | 46 | 9 |
| 14 | 50 | 4 | 14 | 51 | 2 | 14 | 52 | 3 | 14 | 53 | 2 | 14 | 54 | 6 |
| 15 | 58 | 0 | 15 | 59 | 1 | 15 | 60 | 5 | 15 | 61 | 7 | 15 | 63 | 2 |
| 16 | 65 | 6 | 16 | 67 | 0 | 16 | 68 | 5 | 16 | 70 | 0 | 16 | 71 | 5 |
| 17 | 73 | 8 | 17 | 75 | 3 | 17 | 77 | 0 | 17 | 78 | 8 | 17 | 80 | 4 |
| 18 | 83 | 3 | 18 | 84 | 5 | 18 | 86 | 4 | 18 | 88 | 0 | 18 | 90 | 3 |
| 19 | 92 | 4 | 19 | 94 | 3 | 19 | 96 | 3 | 19 | 98 | 3 | 19 | 100 | 7 |
| 20 | 102 | 5 | 20 | 105 | 0 | 20 | 107 | 0 | 20 | 109 | 3 | 20 | 12 | 0 |
| 21 | 13 | 0 | 21 | 15 | 3 | 21 | 17 | 4 | 21 | 20 | 0 | 21 | 21 | 5 |
| 22 | 23 | 5 | 22 | 26 | 7 | 22 | 29 | 0 | 22 | 32 | 0 | 22 | 35 | 0 |
| 23 | 35 | 5 | 23 | 38 | 5 | 23 | 41 | 5 | 23 | 44 | 0 | 33 | 47 | 5 |
| 24 | 47 | 0 | 24 | 50 | 8 | 24 | 53 | 5 | 24 | 57 | 0 | 24 | 60 | 7 |
| 25 | 60 | 5 | 25 | 63 | 5 | 25 | 67 | 0 | 25 | 71 | 0 | 25 | 72 | 5 |
| 26 | 73 | 2 | 26 | 77 | 5 | 26 | 81 | 5 | 26 | 83 | 2 | 26 | 89 | 0 |
| 27 | 87 | 0 | 27 | 91 | 0 | 27 | 95 | 0 | 27 | 98 | 4 | 27 | 202 | 5 |
| 28 | 201 | 5 | 28 | 205 | 0 | 28 | 209 | 0 | 28 | 214 | 0 | 28 | 17 | 5 |
| 29 | 14 | 0 | 29 | 18 | 0 | 29 | 24 | 0 | 29 | 28 | 0 | 29 | 33 | 5 |
| 30 | 30 | 0 | 30 | 35 | 7 | 30 | 40 | 3 | 30 | 45 | 0 | 30 | 50 | 0 |
| 31 | 45 | 5 | 31 | 52 | 0 | 31 | 57 | 0 | 31 | 62 | 5 | 31 | 67 | 5 |
| 32 | 62 | 5 | 32 | 67 | 2 | 32 | 74 | 0 | 32 | 78 | 5 | 32 | 85 | 0 |
| 33 | 78 | 0 | 33 | 85 | 0 | 33 | 91 | 5 | 33 | 96 | 5 | 33 | 303 | 5 |
| 34 | 95 | 0 | 34 | 302 | 5 | 34 | 308 | 0 | 34 | 315 | 0 | 24 | 21 | 5 |
| 35 | 313 | 4 | 35 | 20 | 0 | 35 | 27 | 2 | 35 | 33 | 5 | 35 | 40 | 0 |
| 36 | 32 | 1 | 36 | 38 | 0 | 36 | 45 | 0 | 36 | 53 | 0 | 36 | 61 | 0 |
| 37 | 52 | 0 | 37 | 59 | 1 | 37 | 66 | 3 | 37 | 74 | 0 | 37 | 82 | 5 |
| 38 | 70 | 0 | 38 | 78 | 7 | 38 | 86 | 5 | 38 | 94 | 0 | 38 | 403 | 0 |
| 39 | 90 | 0 | 39 | 98 | 5 | 39 | 407 | 5 | 39 | 416 | 0 | 39 | 23 | 5 |
| 40 | 411 | 2 | 40 | 418 | 5 | 40 | 27 | 6 | 40 | 36 | 5 | 40 | 46 | 0 |

| Diameter, Ins. | 52 Ft. Long. Contents. | | Diameter, Ins. | 53 Ft. Long. Contents. | | Diameter, Ins. | 54 Ft. Long. Contents. | | Diameter, Ins. | 55 Ft. Long. Contents. | | Diameter, Ins. | 56 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 10 | 2 | 6 | 10 | 4 | 6 | 10 | 6 | 6 | 10 | 8 | 6 | 11 | 0 |
| 7 | 13 | 9 | 7 | 14 | 1 | 7 | 14 | 4 | 7 | 14 | 7 | 7 | 14 | 9 |
| 8 | 18 | 2 | 8 | 18 | 5 | 8 | 18 | 8 | 8 | 19 | 3 | 8 | 19 | 5 |
| 9 | 22 | 8 | 9 | 23 | 3 | 9 | 23 | 7 | 9 | 24 | 3 | 9 | 24 | 7 |
| 10 | 28 | 4 | 10 | 28 | 8 | 10 | 29 | 4 | 10 | 30 | 0 | 10 | 30 | 7 |
| 11 | 34 | 3 | 11 | 34 | 9 | 11 | 35 | 5 | 11 | 36 | 4 | 11 | 36 | 8 |
| 12 | 40 | 9 | 12 | 41 | 5 | 12 | 42 | 4 | 12 | 43 | 3 | 12 | 44 | 0 |
| 13 | 47 | 8 | 13 | 48 | 7 | 13 | 49 | 7 | 13 | 50 | 7 | 13 | 51 | 5 |
| 14 | 55 | 5 | 14 | 56 | 5 | 14 | 57 | 7 | 14 | 58 | 8 | 14 | 59 | 8 |
| 15 | 64 | 3 | 15 | 65 | 4 | 15 | 66 | 6 | 15 | 67 | 2 | 15 | 69 | 3 |
| 16 | 72 | 7 | 16 | 74 | 0 | 16 | 75 | 4 | 16 | 77 | 0 | 16 | 78 | 5 |
| 17 | 82 | 2 | 17 | 83 | 3 | 17 | 84 | 8 | 17 | 86 | 5 | 17 | 88 | 0 |
| 18 | 92 | 0 | 18 | 93 | 5 | 18 | 95 | 5 | 18 | 96 | 4 | 18 | 98 | 7 |
| 19 | 101 | 3 | 19 | 104 | 0 | 19 | 106 | 5 | 19 | 108 | 7 | 19 | 110 | 7 |
| 20 | 14 | 0 | 20 | 15 | 5 | 20 | 17 | 9 | 20 | 20 | 5 | 20 | 22 | 5 |
| 21 | 25 | 0 | 21 | 27 | 0 | 21 | 29 | 0 | 21 | 32 | 3 | 21 | 34 | 4 |
| 22 | 37 | 5 | 22 | 39 | 5 | 22 | 42 | 3 | 22 | 45 | 3 | 22 | 48 | 0 |
| 23 | 50 | 5 | 23 | 53 | 0 | 23 | 55 | 3 | 23 | 59 | 0 | 23 | 60 | 0 |
| 24 | 61 | 5 | 24 | 66 | 5 | 24 | 69 | 5 | 24 | 73 | 0 | 24 | 77 | 0 |
| 25 | 78 | 0 | 25 | 81 | 0 | 25 | 84 | 5 | 25 | 88 | 0 | 25 | 91 | 5 |
| 26 | 92 | 8 | 26 | 95 | 5 | 26 | 98 | 5 | 26 | 203 | 0 | 26 | 207 | 0 |
| 27 | 214 | 0 | 27 | 209 | 0 | 27 | 217 | 0 | 27 | 17 | 0 | 27 | 32 | 0 |
| 28 | 23 | 0 | 28 | 26 | 0 | 28 | 32 | 5 | 28 | 35 | 5 | 28 | 38 | 5 |
| 29 | 37 | 5 | 29 | 42 | 0 | 29 | 47 | 0 | 29 | 52 | 0 | 29 | 56 | 0 |
| 30 | 55 | 0 | 30 | 60 | 0 | 30 | 65 | 0 | 30 | 70 | 0 | 30 | 75 | 0 |
| 31 | 73 | 0 | 31 | 77 | 5 | 31 | 83 | 4 | 31 | 88 | 0 | 31 | 94 | 3 |
| 32 | 91 | 0 | 32 | 95 | 0 | 32 | 303 | 0 | 32 | 307 | 5 | 32 | 313 | 5 |
| 33 | 310 | 0 | 33 | 315 | 0 | 33 | 22 | 2 | 33 | 26 | 5 | 33 | 34 | 0 |
| 34 | 29 | 0 | 34 | 33 | 0 | 34 | 41 | 5 | 34 | 46 | 0 | 34 | 54 | 5 |
| 35 | 47 | 5 | 35 | 54 | 5 | 35 | 62 | 0 | 35 | 67 | 0 | 35 | 75 | 0 |
| 36 | 67 | 0 | 36 | 74 | 8 | 36 | 83 | 0 | 36 | 89 | 0 | 36 | 96 | 5 |
| 37 | 90 | 0 | 37 | 97 | 0 | 37 | 405 | 0 | 37 | 413 | 5 | 37 | 413 | 0 |
| 38 | 411 | 0 | 38 | 416 | 5 | 38 | 26 | 4 | 38 | 33 | 0 | 38 | 41 | 5 |
| 39 | 32 | 0 | 39 | 40 | 0 | 39 | 49 | 5 | 39 | 56 | 2 | 39 | 66 | 3 |
| 40 | 54 | 3 | 40 | 63 | 5 | 40 | 72 | 0 | 40 | 81 | 5 | 40 | 89 | 5 |

| Diameter, Ins. | 57 Ft. Long. Contents. | | Diameter, Ins. | 58 Ft. Long. Contents. | | Diameter, Ins. | 59 Ft. Long. Contents. | | Diameter, Ins. | 60 Ft. Long. Contents. | | Diameter, Ins. | 61 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 11 | 2 | 6 | 11 | 4 | 6 | 11 | 5 | 6 | 11 | 8 | 6 | 12 | 0 |
| 7 | 15 | 2 | 7 | 15 | 5 | 7 | 15 | 8 | 7 | 16 | 0 | 7 | 16 | 3 |
| 8 | 19 | 6 | 8 | 20 | 5 | 8 | 20 | 6 | 8 | 20 | 9 | 8 | 21 | 3 |
| 9 | 25 | 1 | 9 | 25 | 7 | 9 | 26 | 0 | 9 | 26 | 4 | 9 | 26 | 3 |
| 10 | 31 | 2 | 10 | 31 | 7 | 10 | 32 | 3 | 10 | 32 | 7 | 10 | 33 | 4 |
| 11 | 37 | 6 | 11 | 38 | 4 | 11 | 38 | 8 | 11 | 39 | 6 | 11 | 40 | 3 |
| 12 | 44 | 3 | 12 | 45 | 7 | 12 | 46 | 5 | 12 | 47 | 4 | 12 | 48 | 0 |
| 13 | 52 | 4 | 13 | 53 | 5 | 13 | 54 | 4 | 13 | 55 | 4 | 13 | 56 | 3 |
| 14 | 60 | 3 | 14 | 62 | 0 | 14 | 63 | 3 | 14 | 64 | 2 | 14 | 65 | 3 |
| 15 | 70 | 5 | 15 | 72 | 2 | 15 | 73 | 2 | 15 | 74 | 3 | 15 | 75 | 7 |
| 16 | 79 | 7 | 16 | 81 | 5 | 16 | 82 | 7 | 16 | 84 | 4 | 16 | 85 | 5 |
| 17 | 89 | 5 | 17 | 91 | 5 | 17 | 92 | 8 | 17 | 94 | 5 | 17 | 96 | 2 |
| 18 | 101 | 0 | 18 | 103 | 0 | 18 | 104 | 8 | 18 | 106 | 5 | 18 | 108 | 5 |
| 19 | 12 | 0 | 19 | 14 | 5 | 19 | 16 | 2 | 19 | 18 | 0 | 19 | 20 | 3 |
| 20 | 25 | 0 | 20 | 27 | 0 | 20 | 29 | 0 | 20 | 31 | 5 | 20 | 33 | 5 |
| 21 | 37 | 3 | 21 | 39 | 6 | 21 | 42 | 0 | 21 | 42 | 6 | 21 | 46 | 5 |
| 22 | 50 | 4 | 22 | 43 | 0 | 22 | 55 | 7 | 22 | 58 | 5 | 22 | 61 | 4 |
| 23 | 64 | 5 | 23 | 68 | 0 | 23 | 71 | 0 | 23 | 73 | 5 | 23 | 77 | 0 |
| 24 | 79 | 5 | 24 | 83 | 0 | 24 | 86 | 0 | 24 | 89 | 0 | 24 | 92 | 8 |
| 25 | 85 | 0 | 25 | 98 | 2 | 25 | 202 | 5 | 25 | 205 | 0 | 25 | 207 | 0 |
| 26 | 210 | 0 | 26 | 213 | 5 | 26 | 17 | 5 | 26 | 21 | 5 | 26 | 25 | 0 |
| 27 | 25 | 3 | 27 | 30 | 0 | 27 | 34 | 0 | 27 | 38 | 0 | 27 | 42 | 0 |
| 28 | 43 | 5 | 28 | 47 | 5 | 28 | 52 | 5 | 28 | 57 | 0 | 28 | 62 | 2 |
| 29 | 62 | 3 | 29 | 65 | 0 | 29 | 70 | 0 | 29 | 74 | 2 | 29 | 79 | 0 |
| 30 | 81 | 5 | 30 | 85 | 2 | 30 | 87 | 5 | 30 | 94 | 0 | 30 | 300 | 0 |
| 31 | 300 | 0 | 31 | 305 | 0 | 31 | 309 | 0 | 31 | 315 | 0 | 31 | 21 | 0 |
| 32 | 20 | 2 | 32 | 25 | 0 | 32 | 30 | 0 | 32 | 35 | 0 | 32 | 42 | 5 |
| 33 | 40 | 0 | 33 | 45 | 5 | 33 | 52 | 0 | 33 | 56 | 5 | 33 | 64 | 0 |
| 34 | 61 | 5 | 34 | 65 | 5 | 34 | 73 | 5 | 34 | 78 | 0 | 34 | 85 | 0 |
| 35 | 82 | 5 | 35 | 87 | 0 | 35 | 95 | 0 | 35 | 402 | 3 | 35 | 408 | 0 |
| 36 | 105 | 0 | 36 | 409 | 0 | 36 | 416 | 3 | 36 | 24 | 0 | 36 | 31 | 5 |
| 37 | 27 | 3 | 37 | 33 | 3 | 37 | 42 | 0 | 37 | 48 | 0 | 37 | 56 | 5 |
| 38 | 51 | 0 | 38 | 56 | 5 | 38 | 65 | 0 | 38 | 74 | 0 | 38 | 82 | 0 |
| 39 | 75 | 0 | 39 | 82 | 0 | 39 | 91 | 0 | 39 | 98 | 5 | 39 | 507 | 2 |
| 40 | 98 | 5 | 40 | 506 | 5 | 40 | 516 | 2 | 40 | 524 | 4 | 40 | 33 | 3 |

| Diameter, Ins. | 62 Ft. Long. Contents. | | Diameter, Ins. | 63 Ft. Long. Contents. | | Diameter, Ins. | 64 Ft. Long. Contents. | | Diameter, Ins. | 65 Ft. Long. Contents. | | Diameter, Ins. | 66 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 12 | 2 | 6 | 12 | 4 | 6 | 12 | 6 | 6 | 12 | 8 | 6 | 13 | 0 |
| 7 | 16 | 6 | 7 | 16 | 9 | 7 | 17 | 2 | 7 | 17 | 4 | 7 | 17 | 7 |
| 8 | 21 | 6 | 8 | 22 | 0 | 8 | 22 | 4 | 8 | 22 | 7 | 8 | 23 | 1 |
| 9 | 27 | 3 | 9 | 27 | 7 | 9 | 28 | 2 | 9 | 28 | 7 | 9 | 29 | 2 |
| 10 | 33 | 8 | 10 | 34 | 5 | 10 | 35 | 2 | 10 | 35 | 6 | 10 | 36 | 2 |
| 11 | 40 | 8 | 11 | 41 | 6 | 11 | 42 | 3 | 11 | 42 | 9 | 11 | 43 | 6 |
| 12 | 48 | 7 | 12 | 49 | 6 | 12 | 50 | 4 | 12 | 51 | 3 | 12 | 52 | 0 |
| 13 | 57 | 2 | 13 | 58 | 2 | 13 | 59 | 0 | 13 | 59 | 8 | 13 | 60 | 8 |
| 14 | 66 | 2 | 14 | 67 | 4 | 14 | 68 | 5 | 14 | 69 | 7 | 14 | 70 | 6 |
| 15 | 76 | 7 | 15 | 77 | 0 | 15 | 78 | 4 | 15 | 80 | 9 | 15 | 82 | 2 |
| 16 | 86 | 8 | 16 | 88 | 3 | 16 | 89 | 5 | 16 | 91 | 5 | 16 | 92 | 5 |
| 17 | 97 | 5 | 17 | 99 | 0 | 17 | 100 | 8 | 17 | 103 | 0 | 17 | 104 | 5 |
| 18 | 109 | 5 | 18 | 112 | 0 | 18 | 13 | 5 | 18 | 15 | 0 | 18 | 17 | 0 |
| 19 | 22 | 0 | 19 | 24 | 4 | 19 | 26 | 2 | 19 | 28 | 5 | 19 | 30 | 7 |
| 20 | 36 | 0 | 20 | 38 | 0 | 20 | 40 | 7 | 20 | 42 | 8 | 20 | 45 | 0 |
| 21 | 48 | 8 | 21 | 51 | 5 | 21 | 54 | 2 | 21 | 56 | 5 | 21 | 59 | 0 |
| 22 | 63 | 5 | 22 | 65 | 0 | 22 | 69 | 5 | 22 | 72 | 5 | 22 | 75 | 0 |
| 23 | 79 | 0 | 23 | 83 | 0 | 23 | 85 | 3 | 23 | 89 | 0 | 23 | 91 | 3 |
| 24 | 95 | 0 | 24 | 98 | 0 | 24 | 202 | 0 | 24 | 205 | 0 | 24 | 207 | 5 |
| 25 | 211 | 5 | 25 | 214 | 5 | 24 | 18 | 0 | 25 | 22 | 2 | 25 | 25 | 5 |
| 26 | 28 | 0 | 26 | 32 | 5 | 26 | 26 | 0 | 26 | 40 | 0 | 26 | 43 | 2 |
| 27 | 46 | 0 | 27 | 51 | 0 | 27 | 54 | 2 | 27 | 58 | 0 | 27 | 62 | 5 |
| 28 | 65 | 0 | 28 | 70 | 0 | 28 | 73 | 5 | 28 | 77 | 2 | 28 | 92 | 5 |
| 29 | 83 | 5 | 29 | 88 | 0 | 29 | 93 | 5 | 29 | 97 | 5 | 29 | 303 | 0 |
| 30 | 305 | 2 | 30 | 309 | 5 | 30 | 315 | 0 | 30 | 319 | 5 | 30 | 24 | 5 |
| 31 | 25 | 5 | 31 | 32 | 0 | 31 | 35 | 5 | 31 | 42 | 0 | 31 | 46 | 5 |
| 32 | 46 | 0 | 32 | 53 | 0 | 32 | 58 | 5 | 32 | 64 | 5 | 32 | 70 | 5 |
| 33 | 68 | 0 | 33 | 75 | 0 | 33 | 83 | 0 | 33 | 87 | 5 | 33 | 94 | 0 |
| 34 | 90 | 0 | 34 | 97 | 2 | 34 | 404 | 7 | 34 | 411 | 5 | 34 | 416 | 5 |
| 35 | 414 | 0 | 35 | 421 | 5 | 35 | 26 | 5 | 35 | 34 | 0 | 35 | 42 | 0 |
| 36 | 37 | 3 | 36 | 45 | 0 | 36 | 53 | 2 | 36 | 59 | 0 | 36 | 67 | 0 |
| 37 | 64 | 0 | 37 | 71 | 5 | 37 | 80 | 0 | 37 | 87 | 5 | 37 | 95 | 0 |
| 38 | 88 | 0 | 38 | 96 | 5 | 38 | 504 | 5 | 38 | 513 | 5 | 38 | 511 | 2 |
| 39 | 515 | 5 | 39 | 523 | 5 | 39 | 32 | 5 | 39 | 41 | 3 | 39 | 48 | 5 |
| 40 | 41 | 4 | 40 | 51 | 0 | 40 | 57 | 5 | 40 | 67 | 0 | 40 | 76 | 5 |

| Diameter, Ins. | 67 Ft. Long. Contents. | | Diameter, Ins. | 68 Ft. Long. Contents. | | Diameter, Ins. | 69 Ft. Long. Contents. | | Diameter, Ins. | 70 Ft. Long. Contents. | | Diameter, Ins. | 71 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 13 | 2 | 6 | 13 | 4 | 6 | 13 | 6 | 6 | 13 | 7 | 6 | 13 | 9 |
| 7 | 18 | 0 | 7 | 18 | 2 | 7 | 19 | 5 | 7 | 18 | 7 | 7 | 19 | 0 |
| 8 | 23 | 4 | 8 | 23 | 6 | 8 | 24 | 2 | 8 | 24 | 4 | 8 | 24 | 7 |
| 9 | 29 | 5 | 9 | 29 | 7 | 9 | 30 | 3 | 9 | 30 | 7 | 9 | 31 | 3 |
| 10 | 36 | 6 | 10 | 37 | 2 | 10 | 37 | 6 | 10 | 38 | 2 | 10 | 38 | 3 |
| 11 | 44 | 2 | 11 | 44 | 7 | 11 | 45 | 5 | 11 | 46 | 1 | 11 | 46 | 7 |
| 12 | 52 | 6 | 12 | 53 | 4 | 12 | 54 | 3 | 12 | 54 | 9 | 12 | 56 | 3 |
| 13 | 61 | 5 | 13 | 62 | 5 | 13 | 63 | 5 | 13 | 64 | 3 | 13 | 65 | 0 |
| 14 | 71 | 7 | 14 | 72 | 5 | 14 | 73 | 6 | 14 | 74 | 5 | 14 | 75 | 8 |
| 15 | 83 | 4 | 15 | 84 | 3 | 15 | 85 | 5 | 15 | 86 | 5 | 15 | 87 | 3 |
| 16 | 94 | 0 | 16 | 95 | 3 | 16 | 96 | 5 | 16 | 97 | 8 | 16 | 99 | 2 |
| 17 | 106 | 0 | 17 | 107 | 2 | 17 | 109 | 0 | 17 | 110 | 5 | 17 | 114 | 0 |
| 18 | 18 | 5 | 18 | 12 | 5 | 18 | 22 | 5 | 18 | 23 | 5 | 18 | 25 | 5 |
| 19 | 32 | 5 | 19 | 34 | 0 | 19 | 36 | 5 | 19 | 38 | 0 | 19 | 40 | 0 |
| 20 | 46 | 8 | 20 | 48 | 5 | 20 | 51 | 5 | 20 | 53 | 0 | 20 | 55 | 2 |
| 21 | 61 | 2 | 21 | 63 | 2 | 21 | 61 | 5 | 21 | 68 | 0 | 21 | 71 | 0 |
| 22 | 78 | 0 | 22 | 80 | 5 | 22 | 83 | 0 | 22 | 85 | 0 | 22 | 88 | 0 |
| 23 | 94 | 0 | 23 | 96 | 0 | 23 | 99 | 0 | 23 | 204 | 0 | 23 | 205 | 0 |
| 24 | 211 | 5 | 24 | 213 | 0 | 24 | 216 | 5 | 24 | 18 | 0 | 24 | 22 | 5 |
| 25 | 28 | 0 | 25 | 32 | 0 | 25 | 35 | 5 | 25 | 37 | 0 | 25 | 42 | 0 |
| 26 | 47 | 0 | 26 | 51 | 5 | 26 | 55 | 0 | 26 | 57 | 5 | 26 | 62 | 2 |
| 27 | 66 | 5 | 27 | 69 | 0 | 27 | 74 | 0 | 27 | 76 | 0 | 27 | 81 | 5 |
| 28 | 86 | 5 | 28 | 90 | 0 | 28 | 94 | 5 | 28 | 97 | 5 | 28 | 303 | 5 |
| 29 | 306 | 5 | 29 | 311 | 0 | 29 | 315 | 5 | 29 | 318 | 5 | 29 | 25 | 0 |
| 30 | 28 | 0 | 30 | 33 | 0 | 30 | 37 | 0 | 30 | 43 | 0 | 30 | 48 | 2 |
| 31 | 52 | 0 | 31 | 56 | 0 | 31 | 62 | 0 | 31 | 66 | 0 | 31 | 73 | 0 |
| 32 | 75 | 4 | 32 | 81 | 5 | 32 | 87 | 2 | 32 | 91 | 0 | 32 | 97 | 0 |
| 33 | 98 | 5 | 33 | 404 | 5 | 33 | 411 | 5 | 33 | 415 | 5 | 33 | 422 | 5 |
| 34 | 422 | 5 | 34 | 27 | 0 | 34 | 34 | 5 | 34 | 39 | 0 | 34 | 46 | 5 |
| 35 | 47 | 0 | 35 | 53 | 5 | 35 | 61 | 0 | 35 | 66 | 0 | 35 | 72 | 0 |
| 36 | 74 | 0 | 36 | 79 | 0 | 36 | 88 | 0 | 36 | 94 | 0 | 36 | 501 | 5 |
| 37 | 502 | 0 | 37 | 507 | 0 | 37 | 515 | 5 | 37 | 503 | 5 | 37 | 30 | 0 |
| 38 | 27 | 0 | 38 | 34 | 0 | 38 | 43 | 5 | 38 | 50 | 0 | 38 | 57 | 0 |
| 39 | 55 | 5 | 39 | 63 | 0 | 39 | 73 | 5 | 39 | 80 | 0 | 39 | 88 | 5 |
| 40 | 84 | 0 | 40 | 92 | 2 | 40 | 603 | 5 | 40 | 610 | 0 | 40 | 618 | 5 |

| Diameter, Ins. | 72 Ft. Long. Contents. | | Diameter, Ins. | 73 Ft. Long. Contents. | | Diameter, Ins. | 74 Ft. Long. Contents. | | Diameter, Ins. | 75 Ft. Long. Contents. | | Diameter, Ins. | 76 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 14 | 1 | 6 | 14 | 3 | 6 | 14 | 6 | 6 | 14 | 7 | 6 | 14 | 9 |
| 7 | 19 | 2 | 7 | 19 | 5 | 7 | 19 | 8 | 7 | 20 | 0 | 7 | 20 | 4 |
| 8 | 25 | 2 | 8 | 25 | 5 | 8 | 25 | 8 | 8 | 36 | 2 | 8 | 26 | 6 |
| 9 | 31 | 7 | 9 | 32 | 2 | 9 | 32 | 7 | 9 | 73 | 1 | 9 | 33 | 6 |
| 10 | 39 | 3 | 10 | 39 | 7 | 10 | 40 | 5 | 10 | 41 | 0 | 10 | 41 | 7 |
| 11 | 47 | 5 | 11 | 47 | 3 | 11 | 48 | 9 | 11 | 49 | 4 | 11 | 50 | 4 |
| 12 | 56 | 6 | 12 | 57 | 5 | 12 | 58 | 3 | 12 | 58 | 9 | 12 | 60 | 0 |
| 13 | 65 | 2 | 13 | 68 | 0 | 13 | 67 | 5 | 13 | 69 | 0 | 13 | 70 | 4 |
| 14 | 76 | 7 | 14 | 78 | 0 | 14 | 79 | 4 | 14 | 80 | 3 | 14 | 81 | 5 |
| 15 | 88 | 8 | 15 | 91 | 0 | 15 | 92 | 0 | 15 | 93 | 0 | 15 | 94 | 5 |
| 16 | 100 | 7 | 16 | 102 | 5 | 16 | 104 | 5 | 16 | 105 | 0 | 16 | 107 | 0 |
| 17 | 13 | 5 | 17 | 15 | 0 | 17 | 17 | 0 | 17 | 18 | 0 | 17 | 20 | 5 |
| 18 | 27 | 5 | 18 | 29 | 0 | 18 | 31 | 5 | 18 | 32 | 5 | 18 | 35 | 0 |
| 19 | 41 | 5 | 19 | 44 | 0 | 19 | 46 | 5 | 19 | 47 | 5 | 19 | 50 | 7 |
| 20 | 57 | 0 | 20 | 61 | 0 | 20 | 62 | 5 | 20 | 64 | 0 | 20 | 67 | 0 |
| 21 | 73 | 0 | 21 | 76 | 0 | 21 | 78 | 5 | 21 | 81 | 0 | 21 | 83 | 5 |
| 22 | 91 | 0 | 22 | 93 | 0 | 22 | 96 | 0 | 22 | 97 | 5 | 22 | 200 | 5 |
| 23 | 207 | 0 | 23 | 211 | 0 | 23 | 204 | 0 | 23 | 216 | 5 | 33 | 18 | 0 |
| 24 | 26 | 0 | 24 | 28 | 0 | 24 | 32 | 5 | 24 | 35 | 0 | 24 | 38 | 0 |
| 25 | 46 | 0 | 25 | 48 | 0 | 25 | 52 | 5 | 25 | 56 | 0 | 25 | 59 | 0 |
| 26 | 65 | 5 | 26 | 69 | 0 | 26 | 73 | 5 | 26 | 77 | 0 | 26 | 81 | 5 |
| 27 | 85 | 0 | 27 | 88 | 2 | 27 | 93 | 5 | 27 | 98 | 5 | 27 | 303 | 2 |
| 28 | 307 | 2 | 28 | 312 | 5 | 28 | 316 | 5 | 28 | 310 | 0 | 28 | 25 | 5 |
| 29 | 28 | 0 | 29 | 34 | 0 | 29 | 38 | 0 | 29 | 43 | 0 | 29 | 47 | 3 |
| 30 | 53 | 0 | 30 | 58 | 0 | 30 | 62 | 5 | 30 | 67 | 5 | 30 | 74 | 0 |
| 31 | 77 | 0 | 31 | 84 | 0 | 31 | 89 | 0 | 31 | 94 | 0 | 31 | 99 | 0 |
| 32 | 403 | 5 | 32 | 409 | 0 | 32 | 415 | 0 | 32 | 419 | 0 | 32 | 425 | 3 |
| 33 | 26 | 5 | 33 | 34 | 0 | 33 | 40 | 0 | 33 | 45 | 0 | 33 | 53 | 5 |
| 34 | 53 | 0 | 34 | 59 | 0 | 34 | 66 | 0 | 34 | 73 | 5 | 34 | 79 | 0 |
| 35 | 81 | 0 | 35 | 88 | 0 | 35 | 95 | 0 | 35 | 501 | 0 | 35 | 508 | 0 |
| 36 | 507 | 2 | 36 | 514 | 5 | 36 | 522 | 5 | 36 | 27 | 5 | 36 | 36 | 5 |
| 37 | 37 | 0 | 37 | 45 | 0 | 37 | 53 | 0 | 37 | 59 | 0 | 37 | 67 | 0 |
| 38 | 65 | 0 | 38 | 73 | 0 | 38 | 82 | 0 | 38 | 88 | 0 | 38 | 97 | 5 |
| 39 | 97 | 0 | 39 | 607 | 2 | 39 | 615 | 0 | 39 | 624 | 0 | 39 | 633 | 2 |
| 40 | 627 | 0 | 40 | 36 | 2 | 40 | 45 | 5 | 40 | 54 | 5 | 40 | 64 | 2 |

| Diameter, Ins. | 77 Ft. Long. Contents. | | Diameter, Ins. | 78 Ft. Long. Contents. | | Diameter, Ins. | 79 Ft. Long. Contents. | | Diameter, Ins. | 80 Ft. Long. Contents. | | Diameter, Ins. | 81 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 15 | 1 | 6 | 15 | 3 | 6 | 15 | 5 | 6 | 15 | 7 | 6 | 15 | 8 |
| 7 | 20 | 6 | 7 | 20 | 8 | 7 | 21 | 2 | 7 | 21 | 3 | 7 | 21 | 6 |
| 8 | 26 | 8 | 8 | 27 | 3 | 8 | 27 | 5 | 8 | 27 | 7 | 8 | 28 | 2 |
| 9 | 33 | 9 | 9 | 34 | 4 | 9 | 34 | 8 | 9 | 35 | 2 | 9 | 35 | 5 |
| 10 | 41 | 9 | 10 | 42 | 5 | 10 | 43 | 3 | 10 | 43 | 6 | 10 | 44 | 0 |
| 11 | 50 | 7 | 11 | 51 | 4 | 11 | 52 | 1 | 11 | 52 | 6 | 11 | 53 | 3 |
| 12 | 60 | 4 | 12 | 61 | 3 | 12 | 62 | 2 | 12 | 62 | 6 | 12 | 63 | 5 |
| 13 | 70 | 8 | 13 | 71 | 7 | 13 | 72 | 5 | 13 | 73 | 4 | 13 | 74 | 3 |
| 14 | 82 | 5 | 14 | 83 | 5 | 14 | 84 | 5 | 14 | 85 | 2 | 14 | 86 | 3 |
| 15 | 95 | 5 | 15 | 96 | 5 | 15 | 96 | 7 | 15 | 98 | 8 | 15 | 99 | 8 |
| 16 | 108 | 5 | 16 | 109 | 3 | 16 | 110 | 8 | 16 | 112 | 0 | 16 | 113 | 0 |
| 17 | 21 | 5 | 17 | 23 | 0 | 17 | 24 | 5 | 17 | 26 | 3 | 17 | 27 | 5 |
| 18 | 36 | 7 | 18 | 38 | 5 | 18 | 39 | 5 | 18 | 41 | 5 | 18 | 43 | 0 |
| 19 | 51 | 5 | 19 | 53 | 3 | 19 | 54 | 4 | 19 | 57 | 0 | 19 | 59 | 0 |
| 20 | 66 | 0 | 20 | 71 | 0 | 20 | 73 | 0 | 20 | 75 | 0 | 20 | 77 | 0 |
| 21 | 85 | 2 | 21 | 88 | 0 | 21 | 90 | 5 | 21 | 92 | 5 | 21 | 94 | 5 |
| 22 | 203 | 0 | 22 | 206 | 2 | 22 | 208 | 0 | 22 | 210 | 0 | 22 | 212 | 5 |
| 23 | 22 | 2 | 23 | 24 | 5 | 23 | 27 | 0 | 23 | 29 | 1 | 23 | 32 | 5 |
| 24 | 42 | 0 | 24 | 44 | 0 | 24 | 47 | 5 | 24 | 51 | 5 | 24 | 53 | 5 |
| 25 | 63 | 0 | 25 | 66 | 0 | 25 | 69 | 0 | 25 | 72 | 5 | 26 | 75 | 0 |
| 26 | 84 | 0 | 26 | 87 | 0 | 26 | 91 | 0 | 26 | 94 | 0 | 26 | 95 | 5 |
| 27 | 305 | 5 | 27 | 309 | 0 | 27 | 314 | 0 | 27 | 316 | 3 | 27 | 321 | 0 |
| 28 | 28 | 0 | 28 | 33 | 5 | 28 | 36 | 0 | 28 | 41 | 0 | 28 | 45 | 0 |
| 29 | 53 | 5 | 29 | 56 | 0 | 29 | 62 | 5 | 29 | 65 | 0 | 29 | 68 | 0 |
| 30 | 77 | 5 | 30 | 83 | 6 | 30 | 87 | 0 | 30 | 92 | 5 | 30 | 96 | 5 |
| 31 | 404 | 0 | 31 | 408 | 5 | 31 | 414 | 0 | 31 | 417 | 5 | 31 | 422 | 5 |
| 32 | 30 | 0 | 32 | 35 | 0 | 32 | 42 | 0 | 32 | 45 | 5 | 32 | 52 | 0 |
| 33 | 58 | 0 | 33 | 64 | 2 | 33 | 68 | 5 | 33 | 75 | 0 | 35 | 79 | 0 |
| 34 | 85 | 1 | 34 | 92 | 0 | 34 | 96 | 5 | 34 | 503 | 0 | 34 | 507 | 5 |
| 35 | 514 | 5 | 35 | 520 | 0 | 35 | 526 | 5 | 35 | 33 | 3 | 35 | 36 | 5 |
| 36 | 43 | 5 | 36 | 50 | 0 | 36 | 56 | 0 | 36 | 62 | 5 | 36 | 66 | 5 |
| 37 | 74 | 0 | 37 | 83 | 0 | 37 | 89 | 2 | 37 | 96 | 0 | 37 | 604 | 2 |
| 38 | 606 | 0 | 38 | 614 | 2 | 38 | 622 | 5 | 38 | 628 | 0 | 38 | 34 | 5 |
| 39 | 40 | 0 | 39 | 48 | 3 | 39 | 57 | 2 | 39 | 63 | 5 | 39 | 69 | 5 |
| 40 | 73 | 1 | 40 | 82 | 5 | 40 | 89 | 5 | 40 | 97 | 7 | 40 | 704 | 5 |

| Diameter, Ins. | 82 Ft. Long. Contents. | | Diameter, Ins. | 83 Ft. Long. Contents. | | Diameter, Ins. | 84 Ft. Long. Contents. | | Diameter, Ins. | 85 Ft. Long. Contents. | | Diameter, Ins. | 86 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 16 | 1 | 6 | 16 | 2 | 6 | 16 | 5 | 6 | 16 | 7 | 6 | 16 | 9 |
| 7 | 21 | 8 | 7 | 22 | 2 | 7 | 22 | 4 | 7 | 22 | 7 | 7 | 22 | 9 |
| 8 | 28 | 5 | 8 | 28 | 8 | 8 | 29 | 2 | 8 | 29 | 5 | 8 | 29 | 8 |
| 9 | 36 | 0 | 9 | 36 | 5 | 9 | 36 | 7 | 9 | 37 | 4 | 9 | 37 | 8 |
| 10 | 44 | 6 | 10 | 45 | 3 | 10 | 45 | 6 | 10 | 46 | 4 | 10 | 46 | 9 |
| 11 | 54 | 3 | 11 | 54 | 6 | 11 | 55 | 2 | 11 | 55 | 9 | 11 | 56 | 5 |
| 12 | 64 | 4 | 12 | 65 | 2 | 12 | 65 | 8 | 12 | 66 | 6 | 12 | 67 | 6 |
| 13 | 75 | 5 | 13 | 76 | 3 | 13 | 77 | 0 | 13 | 78 | 3 | 13 | 79 | 3 |
| 14 | 87 | 5 | 14 | 88 | 5 | 14 | 89 | 4 | 14 | 91 | 0 | 14 | 92 | 3 |
| 15 | 101 | 5 | 15 | 102 | 8 | 15 | 103 | 8 | 15 | 105 | 5 | 15 | 106 | 9 |
| 16 | 14 | 7 | 16 | 16 | 2 | 16 | 17 | 0 | 16 | 18 | 8 | 16 | 20 | 6 |
| 17 | 29 | 0 | 17 | 31 | 0 | 17 | 32 | 0 | 17 | 34 | 0 | 17 | 36 | 0 |
| 18 | 45 | 0 | 18 | 47 | 0 | 18 | 48 | 2 | 18 | 50 | 5 | 18 | 52 | 5 |
| 19 | 61 | 0 | 19 | 63 | 0 | 19 | 64 | 5 | 19 | 67 | 0 | 19 | 69 | 0 |
| 20 | 79 | 5 | 20 | 82 | 5 | 20 | 83 | 3 | 20 | 86 | 5 | 20 | 89 | 0 |
| 21 | 97 | 0 | 21 | 99 | 0 | 21 | 202 | 6 | 21 | 204 | 0 | 21 | 206 | 7 |
| 22 | 216 | 0 | 22 | 218 | 0 | 22 | 20 | 0 | 22 | 23 | 5 | 22 | 27 | 0 |
| 23 | 36 | 5 | 23 | 38 | 5 | 23 | 41 | 5 | 23 | 44 | 5 | 23 | 48 | 0 |
| 24 | 56 | 5 | 24 | 60 | 0 | 24 | 62 | 5 | 24 | 67 | 0 | 24 | 70 | 0 |
| 25 | 78 | 5 | 25 | 83 | 0 | 25 | 85 | 0 | 25 | 88 | 5 | 25 | 93 | 5 |
| 26 | 302 | 5 | 26 | 306 | 0 | 26 | 307 | 5 | 26 | 314 | 0 | 26 | 315 | 0 |
| 27 | 25 | 0 | 27 | 28 | 0 | 27 | 31 | 5 | 27 | 36 | 5 | 27 | 41 | 0 |
| 28 | 49 | 0 | 28 | 55 | 5 | 28 | 57 | 0 | 28 | 64 | 3 | 28 | 67 | 0 |
| 29 | 75 | 0 | 29 | 78 | 5 | 29 | 83 | 2 | 29 | 87 | 5 | 29 | 94 | 0 |
| 30 | 403 | 0 | 30 | 406 | 5 | 30 | 410 | 5 | 30 | 416 | 5 | 30 | 422 | 1 |
| 31 | 28 | 2 | 31 | 34 | 5 | 31 | 47 | 5 | 31 | 45 | 0 | 31 | 50 | 0 |
| 32 | 57 | 0 | 32 | 64 | 0 | 32 | 66 | 0 | 32 | 75 | 0 | 32 | 82 | 0 |
| 33 | 86 | 0 | 33 | 94 | 0 | 33 | 96 | 5 | 33 | 505 | 0 | 33 | 505 | 5 |
| 34 | 515 | 2 | 34 | 523 | 2 | 34 | 525 | 0 | 34 | 34 | 2 | 34 | 42 | 5 |
| 35 | 45 | 0 | 35 | 53 | 5 | 35 | 55 | 5 | 35 | 65 | 0 | 35 | 73 | 5 |
| 36 | 76 | 0 | 36 | 84 | 0 | 36 | 89 | 0 | 36 | 99 | 2 | 36 | 607 | 0 |
| 37 | 613 | 0 | 37 | 621 | 0 | 38 | 625 | 0 | 38 | 636 | 0 | 37 | 44 | 5 |
| 38 | 44 | 5 | 38 | 53 | 5 | 38 | 57 | 5 | 38 | 68 | 0 | 38 | 77 | 2 |
| 39 | 82 | 5 | 39 | 89 | 0 | 39 | 95 | 0 | 39 | 706 | 0 | 39 | 715 | 0 |
| 40 | 714 | 5 | 40 | 724 | 0 | 40 | 731 | 5 | 40 | 43 | 5 | 40 | 52 | 5 |

| Diameter, Ins. | 87 Ft. Long. Contents. | | Diameter, Ins. | 88 Ft. Long. Contents. | | Diameter, Ins. | 89 Ft. Long. Contents. | | Diameter, Ins. | 90 Ft. Long. Contents. | | Diameter, Ins. | 91 Ft. Long. Contents. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 17 | 1 | 6 | 17 | 3 | 6 | 17 | 5 | 6 | 17 | 7 | 6 | 17 | 9 |
| 7 | 23 | 2 | 7 | 23 | 4 | 7 | 23 | 7 | 7 | 24 | 1 | 7 | 24 | 3 |
| 8 | 30 | 4 | 8 | 30 | 7 | 8 | 31 | 2 | 8 | 31 | 5 | 8 | 31 | 7 |
| 9 | 38 | 3 | 9 | 38 | 7 | 9 | 39 | 3 | 9 | 39 | 6 | 9 | 39 | 9 |
| 10 | 47 | 5 | 10 | 48 | 0 | 10 | 48 | 7 | 10 | 49 | 3 | 10 | 49 | 6 |
| 11 | 57 | 5 | 11 | 58 | 0 | 11 | 58 | 6 | 11 | 59 | 3 | 11 | 59 | 8 |
| 12 | 68 | 4 | 12 | 69 | 3 | 12 | 70 | 3 | 12 | 70 | 9 | 12 | 71 | 5 |
| 13 | 80 | 0 | 13 | 81 | 0 | 13 | 82 | 0 | 13 | 83 | 0 | 13 | 83 | 7 |
| 14 | 93 | 1 | 14 | 94 | 0 | 14 | 95 | 5 | 14 | 96 | 2 | 14 | 97 | 4 |
| 15 | 108 | 0 | 15 | 109 | 2 | 15 | 110 | 7 | 15 | 111 | 9 | 15 | 112 | 8 |
| 16 | 24 | 0 | 16 | 23 | 0 | 16 | 25 | 0 | 16 | 26 | 2 | 16 | 27 | 4 |
| 17 | 37 | 5 | 17 | 39 | 0 | 17 | 41 | 0 | 17 | 42 | 0 | 17 | 43 | 0 |
| 18 | 154 | 0 | 18 | 55 | 5 | 18 | 57 | 5 | 18 | 59 | 2 | 18 | 61 | 0 |
| 19 | 71 | 5 | 19 | 73 | 3 | 19 | 76 | 5 | 19 | 78 | 0 | 19 | 79 | 2 |
| 20 | 91 | 0 | 20 | 92 | 7 | 20 | 95 | 0 | 20 | 97 | 0 | 20 | 99 | 2 |
| 21 | 208 | 5 | 21 | 211 | 3 | 21 | 214 | 0 | 21 | 216 | 0 | 21 | 217 | 5 |
| 22 | 28 | 0 | 22 | 32 | 0 | 22 | 35 | 0 | 22 | 37 | 0 | 22 | 38 | 5 |
| 23 | 51 | 7 | 33 | 54 | 0 | 23 | 57 | 3 | 23 | 59 | 0 | 23 | 62 | 5 |
| 24 | 73 | 5 | 24 | 76 | 0 | 24 | 78 | 5 | 24 | 83 | 5 | 24 | 85 | 5 |
| 25 | 96 | 5 | 25 | 300 | 0 | 25 | 304 | 2 | 25 | 307 | 0 | 25 | 308 | 9 |
| 26 | 322 | 0 | 26 | 25 | 1 | 26 | 27 | 5 | 26 | 31 | 5 | 26 | 35 | 5 |
| 27 | 45 | 0 | 27 | 48 | 2 | 27 | 53 | 2 | 27 | 57 | 0 | 27 | 60 | 0 |
| 28 | 72 | 5 | 28 | 76 | 5 | 28 | 82 | 0 | 28 | 85 | 0 | 28 | 88 | 2 |
| 29 | 97 | 5 | 29 | 403 | 1 | 29 | 407 | 2 | 29 | 412 | 3 | 29 | 415 | 0 |
| 30 | 426 | 0 | 30 | 32 | 5 | 30 | 36 | 1 | 30 | 41 | 5 | 30 | 44 | 5 |
| 31 | 55 | 0 | 31 | 62 | 0 | 31 | 66 | 0 | 31 | 72 | 0 | 31 | 75 | 0 |
| 32 | 86 | 2 | 32 | 94 | 0 | 32 | 97 | 2 | 32 | 503 | 5 | 32 | 508 | 0 |
| 33 | 516 | 2 | 33 | 523 | 2 | 33 | 527 | 3 | 33 | 34 | 5 | 33 | 39 | 5 |
| 34 | 47 | 1 | 34 | 53 | 5 | 34 | 59 | 0 | 34 | 65 | 0 | 34 | 70 | 0 |
| 35 | 79 | 2 | 35 | 83 | 2 | 35 | 94 | 2 | 35 | 602 | 5 | 35 | 605 | 5 |
| 36 | 614 | 5 | 36 | 623 | 5 | 36 | 629 | 0 | 36 | 35 | 0 | 36 | 40 | 5 |
| 37 | 52 | 5 | 37 | 57 | 5 | 37 | 66 | 2 | 37 | 73 | 5 | 37 | 78 | 5 |
| 38 | 85 | 0 | 38 | 94 | 0 | 38 | 703 | 2 | 38 | 708 | 5 | 38 | 715 | 0 |
| 39 | 723 | 5 | 39 | 733 | 2 | 39 | 41 | 5 | 39 | 48 | 3 | 39 | 55 | 5 |
| 40 | 58 | 8 | 40 | 67 | 5 | 40 | 78 | 3 | 40 | 87 | 3 | 40 | 94 | 3 |

*A Table giving the Side of a Square, equal to a Square inscribed in a given Circle.*

The first and third columns give the diameter in inches, and extend from 6 to 49 inches; the second and fourth, give the square, or side of the stick in inches, and eighths of inches. The first and third columns at the right hand of the double line, are the same as the first mentioned, except they commence at $6\frac{5}{10}$ and extend to $49\frac{5}{10}$;—the second and fourth columns give the square, or side of the stick in inches, and hundredths of inches.

| Diameter in Inches. | Square side, in Ins. and eighths of Ins. | | Diameter in inches. | Square side, in Ins. and eighths of Ins. | | Diameter in Inches, and tenths of Inches. | | Square side, in Ins. & hundredths Ins. | | Diameter in Inches, and tenths of Inches. | | Square side, in Ins. & hundredths, Ins. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 4 | 2 | 28 | 19 | 6 | 6 | 5 | 4 | 59 | 28 | 5 | 20 | 15 |
| 7 | 4 | 7 | 29 | 20 | 4 | 7 | 5 | 5 | 30 | 29 | 5 | 20 | 85 |
| 8 | 5 | 5 | 30 | 21 | 2 | 8 | 5 | 6 | 01 | 30 | 5 | 21 | 56 |
| 9 | 6 | 3 | 31 | 21 | 7 | 9 | 5 | 6 | 71 | 31 | 5 | 22 | 27 |
| 10 | 7 | 0 | 32 | 22 | 5 | 10 | 5 | 7 | 42 | 32 | 5 | 22 | 98 |
| 11 | 7 | 6 | 33 | 23 | 2 | 11 | 5 | 8 | 13 | 33 | 5 | 23 | 68 |
| 12 | 8 | 4 | 34 | 24 | 0 | 12 | 5 | 8 | 83 | 33 | 5 | 24 | 39 |
| 13 | 9 | 1 | 35 | 24 | 6 | 13 | 5 | 9 | 54 | 35 | 5 | 25 | 10 |
| 14 | 9 | 7 | 36 | 25 | 3 | 14 | 5 | 10 | 25 | 36 | 5 | 25 | 80 |
| 15 | 10 | 5 | 37 | 26 | 1 | 15 | 5 | 10 | 96 | 37 | 5 | 26 | 51 |
| 16 | 11 | 2 | 38 | 26 | 7 | 16 | 5 | 11 | 66 | 38 | 5 | 27 | 22 |
| 17 | 12 | 0 | 39 | 27 | 4 | 17 | 5 | 12 | 37 | 39 | 5 | 27 | 93 |
| 18 | 12 | 6 | 40 | 28 | 2 | 18 | 5 | 13 | 08 | 40 | 5 | 28 | 63 |
| 19 | 13 | 3 | 41 | 29 | 0 | 19 | 5 | 13 | 78 | 41 | 5 | 29 | 34 |
| 20 | 14 | 1 | 42 | 29 | 6 | 20 | 5 | 14 | 49 | 42 | 5 | 30 | 05 |
| 21 | 14 | 7 | 43 | 30 | 3 | 21 | 5 | 15 | 20 | 43 | 5 | 30 | 75 |
| 22 | 15 | 4 | 44 | 31 | 1 | 22 | 5 | 15 | 90 | 44 | 5 | 31 | 46 |
| 23 | 16 | 2 | 45 | 31 | 6 | 23 | 5 | 16 | 61 | 45 | 5 | 32 | 17 |
| 24 | 17 | 0 | 46 | 32 | 4 | 24 | 5 | 17 | 32 | 46 | 5 | 32 | 88 |
| 25 | 17 | 5 | 47 | 33 | 2 | 25 | 5 | 18 | 03 | 47 | 5 | 33 | 58 |
| 26 | 18 | 3 | 48 | 33 | 7 | 26 | 5 | 18 | 73 | 48 | 5 | 34 | 29 |
| 27 | 19 | 0 | 49 | 34 | 5 | 27 | 5 | 19 | 44 | 49 | 5 | 35 | 00 |

# OF SURVEYING.

Land is generally measured by a Chain of 66 feet in length, divided into 100 equal parts, called Links, each Link being 7,92 Inches in length. A Pole or Rod is $16\frac{1}{2}$ feet or 25 links in length: hence a square pole contains $272\frac{1}{4}$ square feet, or 625 square links. An acre of land contains 160 square poles or rods, and 43560 square feet, or 100000 square links

To find the number of square poles in any piece of land, take the dimensions of it in feet and find the area in square feet, and divide this area by 43560, the quotient will be the number of acres; or divide by 272,25 and the quotient will be the number of square poles. If the dimensions be taken in links, and the area found in square links, the number of acres may be obtained by dividing by 100000, or which is the same thing, cut off the five right hand figures but the number of square poles may be found, by dividing by 625.

PROBLEM I. *To find the number of Acres of Land, or the number of Square Poles, in the form of a regular Paralelogram.*

Rule. Multiply the Base or Length by the Perpendicular Height or Breadth, and if the dimensions were taken in Links, divide by 625, if in feet by 272,25, or $272\frac{1}{4}$ the quotient will be the number of Square Poles, which divided by 160 gives the number of Acres.

Example. Suppose the Base be 60 feet and the Perpendicular 25 feet, required the Area in Square poles?

Length 60 feet
Breadth 25 feet

272,25)1500,00(5,5 Ans.
1361,25
138,750
136,125

PROBLEM II. *To find the number of Acres and Poles in a piece of Land in the form of an Oblique Angular Paralelogram.*

Rule. This Area may be found in exactly the same manner as in the preceding problem, by multiplying the base by the Perpendicular height, and dividing by 625;

when the dimensions are taken in Links; by 272,25, when taken in feet, the quotient will be in American Poles, which divided by 160 gives the number of Acres.

EXAMPLE. Suppose the Base be 632 and the perpendicular 326 Links; required the number of Poles?

Base 632 Links
Perp. 326 Links
3792
1264
1896
625)206032(329,6 Poles.
1875
1853
1250
6032
5625
4070

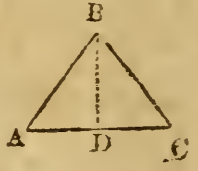
Base 632 Links
Perp. 326 Links
3792
1264
1896
Links 1,00000)2,06032
in an Acre. 4
24128
40
9,65120=to
2 Acres, 0 Roods, and $96\frac{}{100}$ Poles.

PROBLEM III. *To find the number of Acres and Poles in a piece of Land of a Triangular form.*

RULE. Multiply the Base by the Perpendicular height, and divide the product by 1250 when the dimensions are given in Links; by 544,5 when given in feet, and the quotients will be the answer in Poles.

*Note.* Instead of dividing by 1250, you may multiply by 8 and cut off the four right hand figures.

EXAMPLE. Given the Base AC equal to 300 feet, and Perpendicular BD equal to 150 feet; required the Area in Poles.




Perpendicular 150 feet
Base 300 feet
544,5)45000,0(82,6 Poles.
43560
14400
10890
35100

PROBLEM IV. *The three Sides of a Triangle being given, to find the Area Arithmetically.*

RULE. Add together the three sides, from half that sum, subtract each side, severally, noting down the remainders; then multiply the half sum and the three remain-

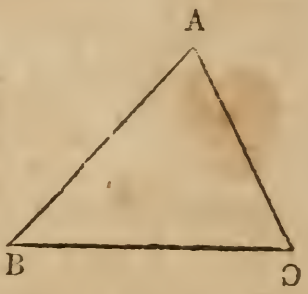
ders continually together, and the square root of the last product will be the Area.

Example. Suppose a Triangle whose three sides are 30, 26, and 22.

Sides, 30+25+22 sum 78÷2=39=—30=9 and 39—26=13 and 39—22=17, the half sums $39\times9\times13\times17=77571$, the square root of which, is equal to 278,5 Chains, or 27 Acres 3 Roods, and 17,5 Poles.

## ON THE SLIDING RULE.

Example in Trigonometry. In the the Oblique Angular Triangle ABC, let there be given AB=56, AC=64, angle ABC 46° 30′, to find the other angles, and the side BC. In this case we have by art, 58 Geometry, the following Canons; as AC 64=Sine ∠B 46° 30′ : : AB 56 : Sine of the Ang. C, to the Ans. And as the Sine ∠B : is to the side AC : : so is the ∠A : BC; therefore to work the first proposition, by the Sliding Rule, we must bring 64, on the Line of numbers, on the fixed part, against 46° 30′ on the Line of Sines on the slider; then against 56 on the fixed part, will be 39° 24′ on the slider, which will be the Angle C. The Angles B and C added together, and their sum being subtracted from 180°, leaves the Angle A =94° 6′. Then by the second Canon being the Angle B =46° 30′ on the Line of Sines, on the slider, against AC=64 on the Line of Numbers on the fixed part; then against the Angle A=94° 6′, or its supplement, 85° 54′ on the slider, will be found the side BC=88 on the fixed part.—In a similar manner may the other propositions of Trigonometry be solved: and from what has been said, it will be easy to work all the problems in Plain Sailing, Middle Latitude Sailing, and Mercator's Sailing, as in the following examples.




Example 1. Given the course, sailed 1 point and the distance 85 miles; required the difference of Latitude and Departure?

By Case 1st. of Plain Sailing, we have these Canons:—

As Radius 8 points, is to the distance 85, so is the Sine Compl. of the Course=7 Poin, to the Ans. or difference of Latitude: and as Radius 8 points, is to the Distance 85 so is the Sine Course 1 Point, to the Departure; hence we must bring the Radius 8 points, on the fixed part of the Line Rhombs, against 85 on the Line of Numbers on the slider; then against 7 points on the Line Rhombs will be found the difference of Latitude $83\frac{1}{2}$ on the slider, and against 1 point, will be found the Departure $16\frac{1}{2}$ miles. If the Course is given in Degrees, you must use the Line marked SIN.

Example 2. Given the difference of Latitude 40 miles, and Departure 30 miles; required the Course and Distance?

As the difference Latitude 40, is to the Radius 45°, so is the Departure 30, to the Tangent of the Course. Therefore, we must bring 40 on the Line of Numbers found on the slider against 45° on the Line of Tangents, on the fixed part; then against 30 on the slider, will be found the Course 37° nearly.

Again; the Canon for the distance given. As the Sine Course 37°, is to the Departure 30, so is Radius 90° to the Distance. Bring 37° on the Line of Sines, on the fixed part, against 30 on the Line of Numbers, on the slider; then against 90° on the Line of Sines, on the fixed part will be found the distance on the slider.

Example 3. Given the middle Latitude Sailing, we have this Canon. As the Sine of Complement of middle Latitude 50°, is to the Departure 30, so is the Radius 90°, to the difference of Longitude. Bring 50° on the Line of Sines on the fixed part, against 30 on the Line of Numbers, on the Slider; then against 90° on the fixed part, will be found 39 on the slider, which will be the difference of the Longitude required.

It may be observed, that in the calculations of Spherical Trigonometry, the Sliding Rule is rather an object of curiosity, than of real use, as it is much more accurate to make those calculations by Logarithms.

How to find the Course when the Base and Perpendicular are given.

Rule. First find the Hypothenuse by the square root, then add one half of the Base to the Hypothenuse. Then

say, as that number is to 86, so is the Perpendicular to the Course.

Example 1. Run North 100 Chains, then West 100 Chains, or Links, or feet, or yards, or miles, or any thing else.

100 100 191,42 : 86° : : 100
100 100 100

10000 10000 191,42)8600.00(44° 55′ 38″ The
10000 7656 8 Course, but it should
20000(141,42 Hypoth. 943 20 be 45°. If instead of
1 50 ½ Base 765 68 86° for the 2d term,
24)100 17752 86,14° had been used, the Ans. would
96 60 have been 45° 0′
281)400 1065120(55 2″ nearly.
281 957100
2824)11900 108020
11296 95710
28282)60400 12310
56564 60
3836 738600(38″
57426
164340
153136
11204

Example 2. Suppose the Base 80 and the Perpendicular 60; what is the Course?

80 60 As 140 : 86,14 : : 60
80 60 60

6400 3600 140)5168,40(36,917°
5600 420 60
10000(100 Hypothenuse 968 55,020
10000 40 half Base 840 60
00000 140 1284 1,200
1260
0240 Ans. 36° 55′ 1⅕″
140
100

Example for finding the Base and Perpendicular. If you run North, 30° East, 70 Rods, what is your Perpendicular?

1. Radius Rods
60,00 : 70 : : 30°
30
60,00)2100,00(35 Rods.
1800 0
30000
30000
00000

2. Reversed Radius Rods
69,22 : 70 : : 60°
60
69,22)4200,00(60,67 Rods.
4153 2
46800
41532
52680
48454
4226

*A Table of Natural Radii.*

| ° | Radii. | | ° | Radii. | | ° | Radii. | | ° | Radii. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 56 | 880 | 24 | 58 | 986 | 47 | 64 | 240 | 70 | 74 | 544 |
| 2 | 56 | 922 | 25 | 59 | 141 | 48 | 64 | 563 | 71 | 75 | 105 |
| 3 | 56 | 967 | 26 | 59 | 300 | 49 | 64 | 895 | 72 | 75 | 661 |
| 4 | 57 | 017 | 27 | 59 | 466 | 50 | 65 | 238 | 73 | 76 | 293 |
| 5 | 57 | 072 | 28 | 59 | 637 | 51 | 65 | 590 | 74 | 76 | 942 |
| 6 | 57 | 130 | 29 | 59 | 815 | 52 | 65 | 950 | 75 | 77 | 608 |
| 7 | 57 | 193 | 30 | 60 | 000 | 53 | 66 | 323 | 76 | 78 | 292 |
| 8 | 57 | 260 | 31 | 60 | 190 | 54 | 66 | 705 | 77 | 78 | 994 |
| 9 | 57 | 331 | 32 | 60 | 388 | 55 | 67 | 093 | 78 | 79 | 714 |
| 10 | 57 | 407 | 33 | 60 | 592 | 56 | 67 | 502 | 79 | 80 | 453 |
| 11 | 57 | 488 | 33 | 60 | 804 | 57 | 67 | 917 | 80 | 81 | 211 |
| 12 | 57 | 573 | 35 | 61 | 021 | 58 | 68 | 343 | 81 | 81 | 990 |
| 13 | 57 | 664 | 36 | 61 | 246 | 59 | 68 | 781 | 82 | 82 | 784 |
| 14 | 57 | 757 | 37 | 61 | 479 | 60 | 69 | 231 | 83 | 83 | 623 |
| 15 | 57 | 857 | 38 | 61 | 719 | 61 | 69 | 692 | 84 | 84 | 452 |
| 16 | 57 | 961 | 39 | 62 | 967 | 62 | 70 | 166 | 85 | 85 | 317 |
| 17 | 58 | 071 | 40 | 62 | 222 | 63 | 70 | 653 | 86 | 86 | 205 |
| 18 | 58 | 180 | 41 | 62 | 485 | 64 | 71 | 153 | 87 | 87 | 116 |
| 19 | 58 | 306 | 42 | 62 | 617 | 65 | 71 | 666 | 88 | 88 | 052 |
| 20 | 58 | 431 | 43 | 63 | 036 | 66 | 72 | 193 | 89 | 89 | 013 |
| 21 | 58 | 562 | 44 | 63 | 323 | 67 | 72 | 734 | 90 | 90 | 000 |
| 22 | 58 | 698 | 45 | 63 | 620 | 68 | 73 | 289 | | | |
| 23 | 58 | 840 | 46 | 63 | 925 | 69 | 73 | 859 | | | |

This Table extends from 1° to 90°, and is made by the following

Rule. Divide four times the square of the Comple-

ment, by three times the Complement, add this to 300, and then add the Angle to the quotient.

EXAMPLE 1. Given 10 Degrees.

| | | | | | |
|---|---|---|---|---|---|
| 90 | | 80 | 540)25600(47,407 | | |
| 10 | | 3 | 2160 | 10 ang. or dg. | |
| 80 | Conplement | 240 | 4000 | 57,407 | Ans. |
| 80 | | 300 | 3780 | | |
| 6400 | sqr. Comp. | 540 Divisor | 220,0 | | |
| 4 | | | 216 0 | | |
| 25600 | Dividend | | 40,00 | | |

EXAMPLE 2. Given the Angle 80 Degrees.

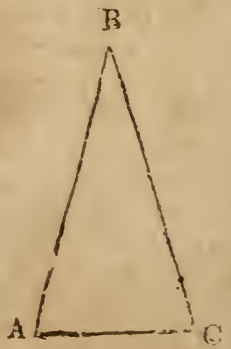
| | | | |
|---|---|---|---|
| 90 | 10×3=30+300=330 | 10 | |
| 80 | | 3 | |
| 10 | Complement. | 30 | |
| 10 | | 300 | |
| 100 | Square of the Complement. | 330 | Divisor. |
| 4 | | | |

330)400(1,212 to which add the Angle

| | | |
|---|---|---|
| 330 | | |
| 700 | 1,212 | |
| 660 | 80 | |
| 400 | 81,212 | Ans. |
| 330 | | |
| 700 | | |

*Application and Use of the Radius Table.*

Given the side AB=16,8 Pole, Angle A=58° to find AC.




In the left hand column, under Deg. find 32, and against it, under Radius you will find 60,4, nearly.

Then as 60,4 : 32 : : AB : BC.

| | |
|---|---|
| | 16,8 |
| | 336 |
| | 504 |
| 60,4)537,6(8.9=Side BC. | |
| | 4832 |
| | 5440 |
| | 5436 |

Then as 68,34 : 58° : : 16,8 ; or as A Radius is to Angle A, so is the Hypothenuse to the Perpendicular.

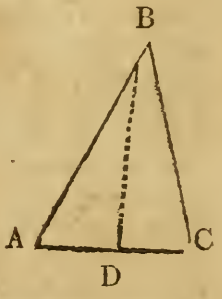
16,8
1344
840

68,34)974,40(14,25 BC.
6834
29100
27336
17640
13668
39720

So that if one Angle, and the Hypothenuse or Course is given of any Right Angled Triangle, the Base and Perpendicular, may easily be found as above.

Oblique Angled Triangles, when the Angles and one side are given, may be solved by the table, by finding the Pependicular.

In the Obliqued Angled Triangle given, AB=100 Miles or Poles, Angle A=60° and Angle C=60° ; required the Perpendicular BD ?




As 60 : 30° : : 100 : 50 AD.
As 69,231 : 60° : : 100 : Ans.

6000
1000

69,231)6000000(86,666 BD Miles, or it may be called Latitude, or Departure, as well as Perpendicular.
553848
461520
415386
461520
415386
459540
415386
441540

*Note.* By adding any two Angles of a Triangle, together, and subtracting their sum from 180 Degrees, will remain the other Angle. Thus, in the Figure, 60 + 60=120, which if subtracted from 180, leaves 60, the Angle B.

# OF LOGARITHMS.

The usual method of computing the Logarithms to any of the natural numbers, 1 2 3 4 5, &c. is as follows :

Rule. 1. Take any two numbers whose difference is unity, or 1, and let the Log. to the lesser number be known.

2. Divide the constant decimal ,868588964, &c. (or 2÷2,3025, &c.) by the sum of the two numbers, and reserve the quotient ; divide the several quotients, by the square of the sum of the two numbers, and reserve the quotient ; divide this last quotient, also, by the square of the sum, and again reserve the quotient ; and thus proceed, continually dividing the last quotient, by the square of the sum of the two numbers, as long as division can be made.

3. Write these quotients in their order, under one another, the first uppermost, and divide respectively by the prime, or odd numbers, 1 3 5 7 9 11 13, &c. as long as division can be made, that is, divide the first reserved quotient by 1, the second by 3, the third by 5, the fourth by 7, and so on.

4. Add all these last quotients together, and their sum will be the Logarithm of the greater number by the less ;— to this Logarithm, add the Logarithm of the lesser number, and their sum will be the Logarithm to the greater, or proposed number.

Example 1. Let it be required to compute the Logarithm of the number 2. Here the given number is 2, and the next less number is 1, (whose Logarithm is ,0000,) and the sum of 2 and 1 is 3, whose square is 9.

| | | |
|---|---|---|
| 3)868588964 | 1)289529654 | 289529654 |
| 9)289529654 | 3)32169962 | 10723321 |
| 9)32169962 | 5)3574440 | 714888 |
| 9)3574440 | 7)397160 | 56737 |
| 9)397160 | 9)44129 | 4903 |
| 9)44129 | 11)4903 | 446 |
| 9)4903 | 13)545 | 42 |
| 9)545 | 15)61 | 4 |
| 9)61 | | ,301029995 |
| | Add Log. of 1. | ,000000000 |
| | True Log. of 2 | ,301029995 Ans. |

Example 2. Let it be required to compute the Loga-

rithm of 3. Here the given number is 3, and the next less is 2, whose Logarithm by the first example is 301029995, and the sum of 2 and 3 is 5, and the square of which is 25.

| | | |
|---|---|---|
| 5)868588963 | 1)173717793 | 173717793 |
| 25)173717793 | 5)6948712 | 2316217 |
| 25)6948712 | 5)277948 | 55590 |
| 25)277948 | 7)11118 | 1528 |
| 25)11118 | 9)445 | 50 |
| 25)445 | 11)18 | 2 |
| 25)18 | | ,176091200 |

Add Log. of 2, ,301029995

Logarithm of 3, 477121198 Ans.

As the sum of the Logarithms of numbers gives the Logarithm of their product, and the difference of the Logarithms gives the Logarithm of the quotient of their numbers. From the above two Logarithms, and the Logarithm of 10 which is 1, we may raise a great many Logarithms, as in the following examples.

EXAMPLE 3.

2×2=4 therefore to the

Logarithm of 2, ,301029995
Add Log. of 2, ,301029995
Logarithm of 4, ,602059990

EXAMPLE 4.

2×3=6 therefore. to the

Log. of 2, ,301029995
Add Log. of 3, ,477121255
Log. of 6, ,778151250

EXAMPLE 5.

2×4=8 therefore, to the

Log. of 2, ,301029995
Add Log. of 4, ,602059990
Logarithm of 8, ,903089985

EXAMPLE 6.

10÷2=5 therefore, from

Log. of 10, 1,000000000
take Log. of 2 0,301029995
Log. of 5, 0,698970005

EXAMPLE 7.

5×8=40 therefore, to the

Log. of 8, ,903089985
Add Log. of 5, ,698970005
Log. of 40, 1,602059990

EXAMPLE 8.

8×40=320 therefore, to

Log. 40, 1,602059990
Add Log. 8, 0,903089985
Log. of 320, 2,505149975

And thus computing by this general rule, the Logarithms of the prime numbers, 1 3 5 7 9 11 13 15 17 19 21 23 25, &c. and then by using composition and division, we may easily find as many Logarithms as we please, or examine any in the Table.

*Directions for taking Logarithms, and their Numbers from the Table.*

Look for the number, whose Logarithm is required, in the Column of Numbers, and against this number, its Logarithm will be found.

Thus; the Logarithm of 1234 is 3,0913151; so that any number less than 10000 may easily be found in the full Table by inspection.

But if the number is greater than 10000, and less than 10000000, cut off four figures on the left of the given number, and find the Logarithm in the Table; add as many units to the Index, as there are figures remaining on the right; subtract the Logarithm found, from the next following it; then as the difference of numbers in the Canon, is to the tabular distance of the Logarithms answering to them, so are the remaining figures of the given number, to the Logarithmic difference; which if it be added to the Logarithm before found, the sum will be the Logarithm required.—Then let the Logarithm of 92375 be required. Cut off the four first figures, 9237, and to the Index of the Logarithm corresponding to them, add one unit, because one figure is cut off, on the right. Then from the Logarithm of the next greater number, 9238=3,9655780, subtract the Log. of the given number, 9237=3,9655309

Indes=10; then* as 10 : 471 : : 5=unit added to 4=to the Index of the Logarithm, corresponding to them; because one figure is cut off, on the right hand, and the Answer will be 235, which added to the Logarithm 4,655309+235=4,9655544=to the Logarithm required.

Or, more briefly, find the Logarithm of the first four figures, as before; then multiply the common difference, which stands against it, by the remaining figures, of the given number; from the product, cut off as many figures at the right hand, as you multiplied by, and add the remainder to the Logarithm before found, fitting it with a proper Index; as the Index must always be one less, than the number of figures in the given natural number; so the Index of the Logarithm for any natural number, less than 10, must be 0; and for any number between 10 and 100, the Index will be 1, and from 100 to 1000, 2 and so on.

---

* If one figure is cut off, say as 10 is to the difference of the Logarithm; if two figures are cut off, as 100 is to the difference; if three, then say as 1000 is to the difference, &c.

The Logarithm of a decimal fraction, is the same as that of a whole number, excepting the Index. Take out then the Logarithm of a whole number, consisting of the same figures, observing to make the negative Index equal to the distance of the first significant figure of the fraction, from the place of units.

EXAMPLE.

| | | |
|---|---|---|
| The Log. of | 0,07643 | is 2,8832639 or 8,8832639 |
| " " | 0,00259 | is 3,4132998 or 7,4132998 |
| " " | 0,0006278 | is 4,7978313 or 6,7978213 |

*To find the Logarithm of a mixed Decimal Fraction.*

Find the Logarithm in the same manner, as if all the figures were integers; and then prefix the Index belonging to the integral part. Thus, the logarithm of 39,68 is 1,5985717, here the Index is 1, because 1 is the Index of the Logarithm of every number greater then 10, and less than 100.

*To find the Logarithm of a Vulgar Fraction.*

Subtract the Logarithm of the denominator from that of the numerator, and the difference will be the Logarithm of the fraction.

What is the Logarithm of $\frac{37}{94}$?

Logarithm of 37, 1,5682017

Logarithm of 94, 1.9731279

1,5950738 when the Index is negative.

*To find the Natural Number to any Logarithm in the Table.*

This is to be done by the reverse of the former, viz. by searching for the proposed Logarithm those in the table, and taking out the corresponding number by inspection, in which the proper number of integers is to be pointed off, viz. one more than the units of the affirmative Index.

*To find the Number corresponding to a Logarithm, greater than any in the Table.*

Frst, subtract the Logarithm of 10, 100, 1000, or 10000 from the given Log. greater than any in the table till you have a Logarithm that will come within the compass of the table; then find the number corresponding to this, and multiply it by 10, 100, 1000,or 10000 the product will be the number required. Suppose the number corresponding to the Logarithm of 7,7589875 be required. Subtract the Logarithm of the number 10000, which is 4,0000000 from 7,7589875, there remains 3,7589875, the natural number

corresponding to which is 5741 ; this multiplied by 10000 gives the number answering to the given Logarithm =57410000.

## MULTIPLICATION BY LOGARITHMS.

Multiplication is performed by taking from the table, Logarithms answering to both factors, and their sum will be the product in Logarithms, the number answering to which, will be the answer. Multiply 45 by 27.

| Numbers. | Logarithms. | Numbers. | Logarithms. |
|---|---|---|---|
| 45 | 1.6532125 | 23,14 | 1,3643634 |
| 27 | 1,4313638 | 75,99 | 1,8807564 |
| 1215 | 3,0845763 | 175842,86 | 3,2451198 |

Multiply 3,586, 0,8372, 0,0294, 2,1046, and add them toghther.

| Numbers. | Logarithms. |
|---|---|
| 3,586 | 0,5546103 |
| 2,1046 | 0,3231696 |
| 0,8372 | 1,9228292 |
| 0,0294 | 2,4683473 |
| 0,185768 | 1,2689564 |

Here the 2 to be carried from the decimals to the Index.—Cancel the 2, and there remains 1 to be set down.

Practical Exampe. What cost 87 pounds of green tea, at $2,12 per pound?

| Numbers. | Logarithms. |
|---|---|
| 2,12 | 0,3263359 |
| 87 | 1,9395193 |
| $184,44 | 2,2658552 |

## DIVISION BY LOGARITHMS.

Rule. From the Logarithm of the dividend, subtract the Logarithm of the divisor, and the number answering to the remainder, will be the quotient required.

Examples. Divide 15811 by 165, and 163 by 8,18.

| | Numbers. | Logarithm | Numbers. | Logarithms. |
|---|---|---|---|---|
| Dividend | 15811 | 4.1989593 | Divd. 163 | 2,2121876 |
| Divisor | 163 | 2,2121876 | Divi. 8.18 | 0,9127533 |
| Quotient | 97 | 1,9867717 | Quo. 19,926 | 1,2994343 |

## PROPORTION, OR RULE OF THREE BY LOG.

Rule. If the proportion be Direct, add the Logarithms of the second and third terms, and subtract from their sum,

the Logarithm of the first term, the remainder will be the term of the Logarithm required.

If the proportion be Inverse, add the Logarithms of the first and second terms, and from their sum, subtract the Logarithm of the third term: the remainder will be the Logarithm to the required term.

EXAMPLE. Find a fourth proportion to 7964, 378, 27960.

| | Numbers. | Logarithms. | | Numbers. | Logarithms. |
|---|---|---|---|---|---|
| 2d. term | 378 | 2,5774918 | | | 7,0240290 |
| 3d. term | 27960 | 4,4465372 | 1st. term | 7964 | 3,9011313 |
| | | 7,0240290 | 4th. term | 1327 | 3,1228977 |

PRACTICAL EXAMPLE. If 6 yards of cloth cost $5, what will 20 yards cost?

| | |
|---|---|
| As 6 Log. | 0,77815 |
| is to 5 Log. | 0,69897 |
| so is 20 Log. | 1,30103 |
| Sum of 2d and 3d | 2,00000 |
| Subtract first 6 | 0,77815 |
| Ans. 16,67 Log. | 1,22185 |

The answer, therefore is 16 dollars and $\frac{67}{100}$ or 16 dollars and 67 cents.

## EVOLUTION BY LOGARITHMS.

RULE. Divide the Logarithm of the number by the Index of the Power, the quotient is the Logarithm of the root sought. But if the power, whose root is to be extracted is a decimal fraction, less than unity, prefix the Index of its Logarithm, a figure less by one, than the Index of the Power,* and divide the whole by the Index of the Power, and the quotient will be the Logarithm of the root sought.

EXAMPLE 1. What is the square root of 196?

196 Log. 2)2,29226

Ans. 14 Log. 1,14613

EXAMPLE 2. What is the cube root of 27?

27 Log. 3)1,43136

Ans. 3 Log. 0,47712

EXAMPLE 3. What is the square root of 40,96?

40,96 Log. 2)1,61236

Ans. 6,4 Log. 0,80618

EXAMPLE 4. What is the cube root of 0,015625

0,015625 Log. 8,19382

Prefix 2 Index, 3) 28,19392

Ans. 0,25 Log. 9,39794

* In this rule it is supposed that 10 was borrowed in finding the Idex of the decimal, according to the rule. Page 97.

# LOGARITHMS

## OF THE NUMBERS, FROM

## 1 to 100.

| No. | Log. | N. | Log. | N. | Log. | N. | Log. |
|---|---|---|---|---|---|---|---|
| 1 | 0. 000000 | 26 | 1. 414973 | 51 | 1. 707570 | 76 | 1. 880814 |
| 2 | 301030 | 27 | 431364 | 52 | 716003 | 77 | 886491 |
| 3 | 477121 | 28 | 447158 | 53 | 724276 | 78 | 892095 |
| 4 | 602060 | 29 | 462398 | 54 | 732394 | 79 | 897627 |
| 5 | 698970 | 30 | 477121 | 55 | 740363 | 80 | 903090 |
| 6 | 778151 | 31 | 491362 | 56 | 748188 | 81 | 908485 |
| 7 | 845098 | 32 | 505150 | 57 | 755875 | 82 | 913814 |
| 8 | 903090 | 33 | 518514 | 58 | 763428 | 83 | 919078 |
| 9 | 954243 | 34 | 531479 | 59 | 770852 | 84 | 924279 |
| 10 | 1. 000000 | 35 | 544068 | 60 | 778151 | 85 | 929419 |
| 11 | 041393 | 36 | 556303 | 61 | 785330 | 86 | 934498 |
| 12 | 079181 | 37 | 568202 | 62 | 792392 | 87 | 939519 |
| 13 | 113943 | 38 | 579784 | 63 | 799341 | 88 | 944483 |
| 14 | 146128 | 39 | 591065 | 64 | 806180 | 89 | 949390 |
| 15 | 176091 | 40 | 602060 | 65 | 812913 | 90 | 954243 |
| 16 | 204120 | 41 | 612784 | 66 | 819544 | 91 | 959041 |
| 17 | 230469 | 42 | 623249 | 67 | 826075 | 92 | 963789 |
| 18 | 255273 | 43 | 633468 | 68 | 832509 | 93 | 968483 |
| 19 | 278754 | 44 | 643453 | 69 | 838849 | 94 | 973128 |
| 20 | 301030 | 45 | 653213 | 70 | 845098 | 95 | 977724 |
| 21 | 322219 | 46 | 662758 | 71 | 851258 | 96 | 982271 |
| 22 | 342423 | 47 | 672098 | 72 | 857333 | 97 | 986772 |
| 23 | 361738 | 48 | 681241 | 73 | 863323 | 98 | 991226 |
| 24 | 380211 | 49 | 690196 | 74 | 869232 | 99 | 995635 |
| 25 | 397940 | 50 | 698970 | 75 | 875061 | 100 | 2. 000000 |

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 2.000000 | 2.000434 | 2.000868 | 3.001301 | 2.001734 | 2.002166 | 2.002598 | 2.003029 | 2.003461 | 2.003891 |
| 101 | 04321 | 04751 | 05181 | 05609 | 06038 | 06466 | 06894 | 07321 | 07748 | 08174 |
| 102 | 08600 | 09026 | 09451 | 09876 | 10300 | 10722 | 11147 | 11570 | 11993 | 12415 |
| 103 | 12837 | 13259 | 13680 | 14100 | 14521 | 14940 | 15360 | 15779 | 16197 | 16616 |
| 104 | 17033 | 17451 | 17868 | 18284 | 18700 | 19116 | 19532 | 19947 | 20361 | 20775 |
| 105 | 21189 | 21603 | 22016 | 28422 | 22841 | 23252 | 23664 | 24075 | 24486 | 24896 |
| 106 | 25306 | 25715 | 26125 | 26533 | 26942 | 27350 | 27757 | 28164 | 28571 | 28978 |
| 107 | 29384 | 29789 | 30195 | 30600 | 31004 | 31408 | 31812 | 32216 | 32619 | 33021 |
| 108 | 33424 | 33826 | 34227 | 34628 | 35029 | 35430 | 35830 | 36230 | 36629 | 37028 |
| 109 | 37426 | 37825 | 38223 | 38620 | 39017 | 39414 | 39811 | 40207 | 40602 | 40998 |
| 110 | 41393 | 41787 | 42182 | 42576 | 42969 | 43362 | 43755 | 44148 | 44540 | 44932 |
| 111 | 45323 | 45714 | 46105 | 46495 | 46885 | 47275 | 47664 | 48053 | 48442 | 48830 |
| 112 | 49218 | 49606 | 49993 | 50380 | 50766 | 51153 | 51538 | 51924 | 52309 | 52694 |
| 113 | 53078 | 53463 | 53846 | 54230 | 54613 | 54996 | 55378 | 55760 | 56142 | 56524 |
| 114 | 56905 | 57286 | 57666 | 58046 | 58426 | 58805 | 59185 | 59563 | 59942 | 60320 |
| 115 | 60698 | 61075 | 61452 | 61829 | 62206 | 62582 | 62958 | 63333 | 63709 | 64083 |
| 116 | 64458 | 64832 | 65206 | 65580 | 65953 | 66326 | 66699 | 67071 | 67443 | 67815 |
| 117 | 68186 | 68557 | 68928 | 69298 | 69668 | 70038 | 70407 | 70776 | 71145 | 71514 |
| 118 | 71882 | 72250 | 72617 | 72985 | 73352 | 73718 | 74085 | 74451 | 74816 | 75182 |
| 119 | 75547 | 75912 | 76276 | 76640 | 77004 | 77368 | 77731 | 78094 | 78457 | 78819 |
| 120 | 79181 | 79543 | 79904 | 80266 | 80626 | 80987 | 81347 | 81707 | 82067 | 82426 |
| 121 | 82785 | 83144 | 83503 | 83861 | 84219 | 84576 | 84934 | 85291 | 85647 | 86004 |
| 122 | 86360 | 86716 | 87071 | 87426 | 87781 | 88136 | 88490 | 88845 | 89198 | 89552 |

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 123 | 2.089905 | 2.090238 | 2.090611 | 2.090963 | 2.091315 | 2.091667 | 2.092018 | 2.092370 | 2.092721 | 2.093071 |
| 124 | 93422 | 93772 | 94122 | 94471 | 94820 | 95169 | 95518 | 95866 | 96215 | 96562 |
| 125 | 96910 | 97257 | 97604 | 97951 | 98298 | 98644 | 98990 | 99335 | 99681 | 100026 |
| 126 | 100371 | 100715 | 101059 | 101403 | 101747 | 102091 | 102434 | 102777 | 103119 | 03462 |
| 127 | 03804 | 04146 | 04487 | 04828 | 05169 | 05510 | 05851 | 06191 | 06531 | 06871 |
| 128 | 07210 | 07549 | 07888 | 08227 | 08565 | 08903 | 09241 | 09579 | 09916 | 10253 |
| 129 | 10590 | 10926 | 11263 | 11599 | 11934 | 12270 | 12605 | 12940 | 13275 | 13609 |
| 130 | 13943 | 14277 | 14611 | 14944 | 15278 | 15611 | 15943 | 16276 | 16608 | 16940 |
| 131 | 17271 | 17603 | 17934 | 18265 | 18595 | 18926 | 19256 | 19586 | 19915 | 20245 |
| 132 | 20574 | 20903 | 21231 | 21560 | 21888 | 22216 | 22544 | 22871 | 23198 | 23525 |
| 133 | 23852 | 24178 | 24504 | 24830 | 25156 | 25481 | 25806 | 26131 | 26456 | 26781 |
| 134 | 27105 | 27429 | 27753 | 28076 | 28399 | 28722 | 29045 | 29368 | 29690 | 30012 |
| 135 | 30334 | 30655 | 30977 | 31298 | 31619 | 31939 | 32260 | 32580 | 32900 | 33219 |
| 136 | 33539 | 33858 | 34177 | 34496 | 34814 | 35133 | 35451 | 35769 | 36086 | 36403 |
| 137 | 36721 | 37037 | 37354 | 37671 | 37987 | 38303 | 38619 | 38934 | 39249 | 39564 |
| 138 | 39879 | 40194 | 40508 | 40822 | 41136 | 41450 | 41763 | 42076 | 42389 | 42702 |
| 139 | 43015 | 43327 | 43639 | 43951 | 44263 | 44574 | 44885 | 45196 | 45507 | 45818 |
| 140 | 46128 | 46438 | 46748 | 47058 | 47367 | 47676 | 47985 | 48294 | 48603 | 48911 |
| 141 | 49219 | 49527 | 49835 | 50142 | 50449 | 50756 | 51063 | 51370 | 51676 | 51982 |
| 142 | 52288 | 52594 | 52900 | 53205 | 53510 | 53815 | 54120 | 54424 | 54728 | 55032 |
| 143 | 55336 | 55640 | 55943 | 56246 | 56549 | 56852 | 57154 | 57457 | 57759 | 58061 |
| 144 | 58362 | 58664 | 58965 | 59266 | 59567 | 59868 | 60168 | 60469 | 60769 | 61068 |
| 145 | 61368 | 61667 | 61967 | 62266 | 62564 | 62863 | 63161 | 63460 | 63758 | 64055 |

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 146 | 2.164353 | 2.164650 | 2.164947 | 2.165244 | 2.165541 | 2.165838 | 2.166134 | 2.166430 | 2.166726 | 2.167022 |
| 147 | 67317 | 67613 | 67908 | 68203 | 68497 | 68792 | 60086 | 69380 | 69674 | 69968 |
| 148 | 70262 | 70555 | 70848 | 71141 | 71434 | 71726 | 72019 | 72311 | 72603 | 72895 |
| 149 | 73186 | 73478 | 73769 | 74060 | 74351 | 74641 | 74932 | 75222 | 75512 | 75802 |
| 150 | 76091 | 76381 | 76670 | 76959 | 77248 | 77536 | 77825 | 78113 | 78401 | 78689 |
| 151 | 78977 | 79264 | 79552 | 79839 | 80126 | 80413 | 80699 | 80986 | 81272 | 81558 |
| 152 | 81844 | 82129 | 82415 | 82700 | 82985 | 83270 | 83555 | 83839 | 84123 | 84407 |
| 153 | 84691 | 84975 | 85259 | 85542 | 85825 | 86108 | 86391 | 86674 | 87956 | 87239 |
| 154 | 87521 | 87803 | 88084 | 88366 | 88647 | 88928 | 89209 | 89490 | 89771 | 90051 |
| 155 | 90332 | 90612 | 90892 | 91171 | 91451 | 91730 | 92010 | 92289 | 92567 | 92846 |
| 156 | 93125 | 93403 | 93681 | 93959 | 94237 | 94514 | 94792 | 95069 | 95346 | 95623 |
| 157 | 95899 | 96176 | 96453 | 96729 | 97005 | 97281 | 97556 | 97832 | 98107 | 98382 |
| 158 | 98657 | 98932 | 99206 | 99481 | 99755 | 200029 | 200303 | 200577 | 200850 | 201124 |
| 159 | 201397 | 201670 | 201943 | 202216 | 202488 | 02761 | 03033 | 03305 | 03577 | 03848 |
| 160 | 04120 | 04391 | 04663 | 04934 | 05204 | 05475 | 05746 | 06016 | 06286 | 06556 |
| 161 | 06826 | 07096 | 07365 | 07634 | 08904 | 08173 | 08442 | 08710 | 08979 | 09247 |
| 162 | 09515 | 09783 | 10051 | 10319 | 10586 | 10853 | 11121 | 11388 | 11654 | 11921 |
| 163 | 12188 | 12454 | 12720 | 12986 | 13252 | 13518 | 13783 | 14049 | 14314 | 14579 |
| 164 | 14844 | 15109 | 15373 | 15638 | 15902 | 16166 | 16430 | 16694 | 16957 | 17221 |
| 165 | 17484 | 17747 | 18010 | 18273 | 18536 | 18798 | 19060 | 19323 | 19585 | 19846 |
| 166 | 20108 | 20370 | 20631 | 20892 | 21153 | 21414 | 21675 | 21936 | 22196 | 22456 |
| 167 | 22716 | 22976 | 23236 | 2349 | 23755 | 24015 | 24274 | 24533 | 24792 | 25051 |
| 168 | 25309 | 25568 | 25826 | 26084 | 26342 | 26600 | 26885 | 27115 | 27372 | 27630 |

| No | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 169 | 2.227887 | 2.228144 | 1.228400 | 2.228657 | 2.228913 | 2.229170 | 2.229426 | 2.229682 | 2.229938 | 2.230193 |
| 170 | 30449 | 30704 | 30960 | 31215 | 31470 | 31724 | 31979 | 32234 | 32238 | 32742 |
| 171 | 32996 | 33250 | 33504 | 33757 | 34011 | 34264 | 34517 | 34770 | 35023 | 35276 |
| 172 | 35528 | 35781 | 36033 | 36285 | 36537 | 36789 | 37041 | 37292 | 37544 | 37795 |
| 173 | 38046 | 38297 | 38548 | 38799 | 39049 | 39299 | 39550 | 39800 | 40050 | 40300 |
| 174 | 40549 | 40799 | 41048 | 41297 | 41546 | 41795 | 42044 | 42293 | 42541 | 42790 |
| 175 | 43038 | 43286 | 43534 | 43782 | 44030 | 44277 | 44525 | 44772 | 45018 | 45266 |
| 176 | 45513 | 45759 | 46006 | 46252 | 46499 | 46745 | 46991 | 47237 | 47482 | 47728 |
| 177 | 47973 | 48219 | 48464 | 48709 | 48954 | 49198 | 49443 | 49687 | 49932 | 50176 |
| 178 | 50420 | 50664 | 50908 | 51151 | 51395 | 51638 | 51881 | 52125 | 52369 | 52610 |
| 179 | 52853 | 53096 | 53338 | 53580 | 53822 | 54064 | 54306 | 54548 | 54790 | 55031 |
| 180 | 55273 | 55514 | 55755 | 55996 | 56237 | 56477 | 56718 | 56958 | 57198 | 57439 |
| 181 | 57679 | 57918 | 58158 | 58398 | 58637 | 58877 | 59116 | 59355 | 59594 | 59833 |
| 182 | 60071 | 60310 | 60548 | 60787 | 61025 | 61263 | 61501 | 61739 | 61976 | 62214 |
| 183 | 62451 | 62688 | 62925 | 63162 | 63399 | 63636 | 63873 | 64109 | 64346 | 64582 |
| 184 | 64818 | 65054 | 65290 | 65525 | 65761 | 65996 | 66232 | 66467 | 66702 | 66937 |
| 185 | 67172 | 67406 | 67641 | 67875 | 68110 | 68344 | 68580 | 68812 | 69046 | 69279 |
| 186 | 69513 | 69746 | 69980 | 70213 | 70446 | 70679 | 70912 | 71144 | 71377 | 71609 |
| 187 | 71842 | 72074 | 72306 | 72538 | 72770 | 73001 | 73233 | 73464 | 73696 | 73927 |
| 188 | 74158 | 74389 | 74620 | 74850 | 75031 | 75311 | 75542 | 75772 | 76002 | 76232 |
| 189 | 76462 | 76692 | 76921 | 77151 | 77380 | 77609 | 77838 | 78067 | 78296 | 78525 |
| 190 | 78754 | 78982 | 79211 | 79439 | 79667 | 79895 | 80123 | 80351 | 80578 | 80806 |
| 191 | 81033 | 81261 | 81488 | 81715 | 81942 | 82169 | 82396 | 82622 | 82849 | 83075 |

# A TRAVERSE TABLE, OR

## DIFFERENCE OF LATITUDE AND DEPARTURE,

When 1 minute is calculated to 5 minutes, and from thence to 10, 15, 20 and so on to 60 minutes or one degree; and from 1 degree to 1 degree and 30 minutes, and to 2 degres, and so on to 90 degrees: and any distance from 1 to 9 poles or chains, by which it may be understood to extend from 10 to 90, or from 100 to 900, or from 1000 to 9000, or from 10000 to 90000, observing to move the separatrix one or more places to the right hand, as the number of cyphers on the right of the integral distance will denote, and the rest will be decimals,the two first of which, on the hand, may at all times be called links, when the distance is given in chains and links.

*Note.* Difference of Latitude is called Northing and Southing. Departure, Meridian Distance, or Longitude are the same as Easting and Westing.

*To find the Latitude and Departure, for any Course and Distance.*

If the Course be more than 45° look for it in the column marked Latitude; if lesr than 45° look for it in the column marked Departure; and look for the Distance at the right or left hand columns: against the Distance, and directly under the Course, stand the Latitude, or Northing, &c. in whole numbers and decimals.

If the Course be less than 45°, the Northing and Southing, will be greater than the Departure, or Easting and Westing, but if more than 45°, the Easting and Westing will be the greatest.

When the Distance exceeds 9, 90, or 900, &c. it will be a Multiple of some numbers, from 1 to 9, or from 10 to 90, &c. Suppose the Distance to be 16, which is a Multiple of 8: double the numbers found against 8, in both Latitude and Departure, and you will have the respective results: for example; suppose the Course 13° 30′, and the Distance 16 Chains. Under 13° 30′, we find under Latitude, 7,778664; this multiplied by 2, gives 15,557328. for the Departure: against 8 we find 1867488, which multiplied by 2 gives 3,734976, which is the answer, for 16. If the

Distance be 17, to the number before found for 16, add the number against 1 : or for 19, double the number against 9, to which add the number against 1 ; and for 20, look against 2, and remove the separatrix one place to the right hand, and so for 30, 40, 50, 60, &c.

Suppose the Course N. 27° 30′ E. and Distance from 3 to 30000.

| | Latitude. | | Departure. |
|---|---|---|---|
| 3 | 2,660931 | 3 | 1,385193 |
| 30 | 26,60931 | 30 | 13,85193 |
| 300 | 266,0931 | 300 | 138,5193 |
| 3000 | 2660,931 | 3000 | 1385,193 |
| 30000 | 26609,31 | 30000 | 13851,93 |

The above Distance may be called Chains, and then the two figures of decimals, next to the separatrix, will be Links or decimals of a Chain.

Again, suppose the Course 22°, and the Distance 70 Chains. Against 7, the Latitude will be 6,490 ; or call it 70, and then remove the point, one place to the right :— thus, 64,90, and so of Departure ; 2,622, altered, makes 26,22 Links, &c.

Suppose the Course as above, and the Distance 70 Links more than the respective Distance. Look against 7, and remove the separatrix one place to the left hand, and then the two decimals will be Links ; as against 7 you will find 6,208, altered, will be 62,08=to 62 Links, and so of any other number of Links, as they are governed by the same laws as whole numbers.

| Dist. | Departure 1′ | Departure. 2′ | Departure. 3′ | Departure 4′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.000291 | 0.000582 | 0 000873 | 0.001164 | 1 |
| 2 | 0 000582 | 0.001164 | 0 001746 | 0.002328 | 2 |
| 3 | 0.000873 | 0.001746 | 0 002619 | 0.003492 | 3 |
| 4 | 0.001164 | 0.002328 | 0.003492 | 0.004656 | 4 |
| 5 | 0 001455 | 0.002910 | 0.004365 | 0.005820 | 5 |
| 6 | 0.001746 | 0.003492 | 0.005238 | 0.006984 | 6 |
| 7 | 0.002037 | 0 004074 | 0.006111 | 0.008148 | 7 |
| 8 | 0 002328 | 0.004656 | 0.006984 | 0.009312 | 8 |
| 9 | 0 002619 | 0.005238 | 0 007857 | 0.010476 | 9 |
| | 5′ | 10′ | 15′ | 20′ | |
| 1 | 0 001454 | 0.002909 | 0.004363 | 0.005817 | 1 |
| 2 | 0 002908 | 0 005818 | 0 008672 | 0 011634 | 2 |
| 3 | 0 004362 | 0 008727 | 0 013008 | 0 017451 | 3 |
| 4 | 0 005816 | 0 011636 | 0 017344 | 0 023268 | 4 |
| 5 | 0 007270 | 0 014545 | 0 021680 | 0 029085 | 5 |
| 6 | 0 008724 | 0 017454 | 0 026016 | 0 034902 | 6 |
| 7 | 0 010178 | 0 020363 | 0 030352 | 0 040719 | 7 |
| 8 | 0 011632 | 0 023272 | 0 034688 | 0 046536 | 8 |
| 9 | 0 013086 | 0 026181 | 0 039024 | 0 052353 | 9 |
| | 25′ | 30′ | 35′ | 40′ | |
| 1 | 0 007272 | 0.008726 | 0.010179 | 0.011633 | 1 |
| 2 | 0 014544 | 0 017452 | 0 020340 | 0 023270 | 2 |
| 3 | 0 021816 | 0 026178 | 0 030510 | 0 034905 | 3 |
| 4 | 0 029088 | 0 034904 | 0 040680 | 0 046540 | 4 |
| 5 | 036360 | 0 043630 | 0 050850 | 0 058175 | 5 |
| 6 | 043632 | 0 052356 | 0 061026 | 0 069810 | 6 |
| 7 | 050904 | 0 061082 | 0 071190 | 0 081445 | 7 |
| 8 | 058176 | 0 069808 | 0 081360 | 0 093080 | 8 |
| 9 | 065448 | 0 078534 | 0 091530 | 0 104715 | 9 |
| | 45′ | 50′ | 55′ | | |
| | 0 013089 | 0.014543 | 0 015997 | | 1 |
| | 0 026178 | 0 029086 | 0 031994 | | 2 |
| | 0 039267 | 0 043629 | 0 047991 | | 3 |
| 4 | 0 052356 | 0 058172 | 0 063988 | | 4 |
| 5 | 0 065445 | 0 072715 | 0 079985 | | 5 |
| 6 | 0 078524 | 0 087258 | 0 095982 | | 6 |
| 7 | 0 091623 | 0 101801 | 0 111979 | | 7 |
| 8 | 0 104712 | 0 116344 | 0 127976 | | 8 |
| 9 | 0 117801 | 0 130870 | 0 143973 | | 9 |

| Dis. | Latitude. 30° | Departure. 1° | Latitude. 89° 30′ | Departure. 1° 30′ | Dis. |
|---|---|---|---|---|---|
| 1 | 0 [illegible] | 0.011452 | 0 [illegible] | 0.026175 | 1 |
| 2 | 1 [illegible] | 0 031904 | 1 [illegible] | 0 052350 | 2 |
| 3 | 2 [illegible] | 0 068356 | 2 [illegible] | 0 078525 | 3 |
| 4 | 3 [illegible] | 0 091808 | 3 [illegible] | 0 104700 | 4 |
| 5 | 4 [illegible] | 0 137260 | 4 [illegible] | 0 130875 | 5 |
| 6 | 5 [illegible] | 0 164712 | 5 [illegible] | 0 157050 | 6 |
| 7 | 6 [illegible] | 0 [illegible] | 6 [illegible] | 0 183225 | 7 |
| 8 | 7 [illegible] | 0 183616 | 7 [illegible] | 0 209400 | 8 |
| 9 | 8 [illegible] | 0 157068 | 8 [illegible] | 0 235574 | 9 |
| | 30° | 2° | 87° 30′ | 2° 30′ | |
| 1 | 0 [illegible] | 0 034999 | 0.998010 | 0.043617 | 1 |
| 2 | 1 [illegible] | 0 060703 | 1 [illegible] | 0 087234 | 2 |
| 3 | 2 [illegible] | 0 104627 | 2 [illegible] | 0 130851 | 3 |
| 4 | 3 [illegible] | 0 139500 | 3 [illegible] | 0 174468 | 4 |
| 5 | 4 [illegible] | 0 174495 | 4 [illegible] | 0 218085 | 5 |
| 6 | 5 [illegible] | 0 209304 | 5 [illegible] | 0 261702 | 6 |
| 7 | 6 [illegible] | 0 244203 | 6 [illegible] | 0 305319 | 7 |
| 8 | 7 [illegible] | 0 279102 | 7 [illegible] | 0 348936 | 8 |
| 9 | 8 [illegible] | 0 314001 | 8 [illegible] | 0 392553 | 9 |
| | 87° | 3° | 86° 30′ | 3° 30′ | |
| 1 | 0.998630 | 0.052336 | 0 [illegible] | 0 [illegible] | 1 |
| 2 | 1 [illegible] | 1 [illegible] | 1 [illegible] | 1 [illegible] | 2 |
| 3 | 2 [illegible] | 0 157008 | 2 [illegible] | 0 183156 | 3 |
| 4 | 3 [illegible] | 0 209344 | 3 [illegible] | 0 244184 | 4 |
| 5 | 4 [illegible] | 0 261680 | 4 [illegible] | 0 305230 | 5 |
| 6 | 5 [illegible] | 0 314016 | 5 [illegible] | 0 366276 | 6 |
| 7 | 6 [illegible] | 0 366352 | 6 [illegible] | 0 427322 | 7 |
| 8 | 7 [illegible] | 0 418688 | 7 [illegible] | 0 488368 | 8 |
| 9 | 8 [illegible] | 0 471024 | 8 [illegible] | 0 549414 | 9 |
| | 86° | 4° | 85° 30′ | 4° 30′ | |
| 1 | 0.994504 | 0.069756 | 0 [illegible] | 0.070456 | 1 |
| 2 | 1 [illegible] | 0 139512 | 1 [illegible] | 0 [illegible] | 2 |
| 3 | 2 [illegible] | 0 209268 | 2 [illegible] | 0 235368 | 3 |
| 4 | 3 [illegible] | 0 279024 | 3 [illegible] | 0 313824 | 4 |
| 5 | 4 [illegible] | 0 348780 | 4 [illegible] | 0 392280 | 5 |
| 6 | 5 [illegible] | 0 418536 | 5 [illegible] | 0 470736 | 6 |
| 7 | 6 [illegible] | 0 488292 | 6 [illegible] | 0 549192 | 7 |
| 8 | 7 [illegible] | 0 558048 | 7 [illegible] | 0 627648 | 8 |
| 9 | 8 [illegible] | 0 627804 | 8 [illegible] | 0 706204 | 9 |

| Dis. | Latitude. 85° | Departure. 5° | Latitude. 84° 30′ | Departure. 5° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.996195 | 0.087156 | 0.995358 | 0.095842 | 1 |
| 2 | 1 992390 | 0 174312 | 1 990716 | 0 191684 | 2 |
| 3 | 2 988590 | 0 261468 | 2 986074 | 0 287526 | 3 |
| 4 | 3 985780 | 0 348624 | 3 981432 | 0 383368 | 4 |
| 5 | 4 980980 | 0 435780 | 4 986790 | 0 479210 | 5 |
| 6 | 5 977180 | 0 522936 | 5 972148 | 0 575052 | 6 |
| 7 | 6 974370 | 0 610092 | 6 977506 | 0 670894 | 7 |
| 8 | 7 971560 | 0 697248 | 7 962864 | 0 766736 | 8 |
| 9 | 8 966760 | 0 784404 | 8 968222 | 0 862578 | 9 |
| | 84° | 6° | 83° 30′ | 6° 30′ | |
| 1 | 0.994522 | 0.104528 | 0.993534 | 0.113198 | 1 |
| 2 | 1 989044 | 0 209056 | 1 987068 | 0 226396 | 2 |
| 3 | 2 983566 | 0 314084 | 2 980602 | 0 339594 | 3 |
| 4 | 3 978088 | 0 418112 | 3 974136 | 0 452792 | 4 |
| 5 | 4 972610 | 0 523140 | 4 967670 | 0 565990 | 5 |
| 6 | 5 967132 | 0 628168 | 5 961204 | 0 679198 | 6 |
| 7 | 6 961654 | 0 732196 | 6 954738 | 0 792386 | 7 |
| 8 | 7 956176 | 0 836224 | 7 948272 | 0 905584 | 8 |
| 9 | 8 950698 | 0 941252 | 8 941806 | 1 018782 | 9 |
| | 83° | 7° | 82° 30′ | 7° 30′ | |
| 1 | 0.992546 | 0.121869 | 0.991407 | 0.130521 | 1 |
| 2 | 1 985092 | 0 243738 | 1 982814 | 0 261042 | 2 |
| 3 | 2 977598 | 0 365607 | 2 974221 | 0 391563 | 3 |
| 4 | 3 970184 | 0 487476 | 3 965628 | 0 522084 | 4 |
| 5 | 4 962650 | 0 609345 | 4 957035 | 0 652605 | 5 |
| 6 | 5 955196 | 0 731214 | 5 948442 | 0 783126 | 6 |
| 7 | 6 948702 | 0 853083 | 6 939849 | 0 913647 | 7 |
| 8 | 7 940368 | 0 974952 | 7 931256 | 1 044168 | 8 |
| 9 | 8 922754 | 1 096821 | 8 931663 | 1 174689 | 9 |
| | 82° | 8° | 81° 30′ | 8° 30′ | |
| 1 | 0.990268 | 0.139173 | 0.988978 | 0.147803 | 1 |
| 2 | 1 980536 | 0 278346 | 1 977956 | 0 295606 | 2 |
| 3 | 2 970804 | 0 417519 | 2 966934 | 0 443409 | 3 |
| 4 | 3 961072 | 0 556692 | 3 955912 | 0 591212 | 4 |
| 5 | 4 951340 | 0 695865 | 4 944890 | 0 739015 | 5 |
| 6 | 5 941608 | 0 835038 | 5 933868 | 0 886818 | 6 |
| 7 | 6 931876 | 0 974311 | 6 922846 | 1 034621 | 7 |
| 8 | 7 922144 | 1 113384 | 7 911824 | 1 182424 | 8 |
| 9 | 8 912412 | 1 252557 | 8 900802 | 1 330227 | 9 |

| Dist. | Latitude. 81° | Departure. 9° | Latitude. 80° 30′ | Departure. 9° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.987688 | 0.156434 | 0.986248 | 0.165041 | 1 |
| 2 | 1 975376 | 0 312868 | 1 972596 | 0 330082 | 2 |
| 3 | 2 963064 | 0 469302 | 2 958844 | 0 495123 | 3 |
| 4 | 3 950752 | 0 625736 | 3 9441 | 0 660164 | 4 |
| 5 | 4 938440 | 0 782170 | 4 931440 | 0 825205 | 5 |
| 6 | 5 926128 | 0 938604 | 5 917688 | 0 990246 | 6 |
| 7 | 6 913816 | 1 095038 | 6 903936 | 1 155287 | 7 |
| 8 | 7 901504 | 1 251472 | 7 888384 | 1 320328 | 8 |
| 9 | 8 889192 | 1 407906 | 8 876832 | 1 485369 | 9 |
| | 80° | 10° | 79° 30′ | 10° 30′ | |
| 1 | 0.984808 | 0.173648 | 0.985217 | 0.182229 | 1 |
| 2 | 1 969616 | 0 357296 | 1 9664 34 | 0 364458 | 2 |
| 3 | 2 954424 | 0 520944 | 2 949651 | 0 546687 | 3 |
| 4 | 3 939232 | 0 694592 | 3 932868 | 0 728916 | 4 |
| 5 | 4 924040 | 0 868240 | 4 916085 | 0 911145 | 5 |
| 6 | 5 908848 | 1 041888 | 5 899302 | 1 093374 | 6 |
| 7 | 6 893656 | 1 215536 | 6 882519 | 1 275603 | 7 |
| 8 | 7 878464 | 1 389184 | 7 865736 | 1 457832 | 8 |
| 9 | 8 863272 | 1 562832 | 8 848953 | 1 640061 | 9 |
| | 79° | 11° | 78° 30′ | 11° 30′ | |
| 1 | 0.981627 | 0.190810 | 0.979887 | 0.199361 | 1 |
| 2 | 1 963254 | 0 381620 | 1 959774 | 0 398722 | 2 |
| 3 | 2 944881 | 0 572430 | 2 939661 | 0 598083 | 3 |
| 4 | 3 926508 | 0 763240 | 3 919548 | 0 797444 | 4 |
| 5 | 4 908135 | 0 954050 | 4 899435 | 0 996805 | 5 |
| 6 | 5 889762 | 1 144860 | 5 879322 | 1 196166 | 6 |
| 7 | 6 871389 | 1 335670 | 6 859209 | 1 395527 | 7 |
| 8 | 7 853016 | 1 526480 | 7 839096 | 1 594888 | 8 |
| 9 | 8 834643 | 1 717290 | 8 818983 | 1 794249 | 9 |
| | 78° | 12° | 77° 30′ | 12° 30′ | |
| 1 | 0.978148 | 0.207912 | 0.976259 | 0.216431 | 1 |
| 2 | 1 956296 | 0 415824 | 1 952518 | 0 432862 | 2 |
| 3 | 2 934444 | 0 623736 | 2 928677 | 0 649293 | 3 |
| 4 | 3 912592 | 0 831648 | 3 904836 | 0 865724 | 4 |
| 5 | 4 890740 | 1 039560 | 4 881095 | 1 082155 | 5 |
| 6 | 5 868888 | 1 247472 | 5 857354 | 1 298586 | 6 |
| 7 | 6 847036 | 1 455386 | 6 833513 | 1 515017 | 7 |
| 8 | 7 825184 | 1 663296 | 7 809672 | 1 731448 | 8 |
| 9 | 8 803332 | 1 871208 | 8 786331 | 1 947879 | 9 |

| Dist. | Latitude. 77° | Departure. 13° | Latitude. 76° 30′ | Departure. 13° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.974370 | 0.224951 | 0.972333 | 0.233436 | 1 |
| 2 | 1 948740 | 0 449901 | 1 944666 | 0 466872 | 2 |
| 3 | 2 923110 | 0 674853 | 2 916999 | 0 700308 | 3 |
| 4 | 3 897480 | 0 899804 | 3 889332 | 0 933744 | 4 |
| 5 | 4 871850 | 1 124755 | 4 861665 | 1 167180 | 5 |
| 6 | 5 846220 | 1 349706 | 5 833998 | 1 400616 | 6 |
| 7 | 6 820590 | 1 574657 | 6 806331 | 1 634052 | 7 |
| 8 | 7 795960 | 1 799608 | 7 778664 | 1 867488 | 8 |
| 9 | 8 769330 | 2 024559 | 8 750997 | 2 100924 | 9 |
| | 76° | 14° | 75° 30′ | 14° 30′ | |
| 1 | 0.970296 | 0.241922 | 0.968111 | 0.250370 | 1 |
| 2 | 1 940592 | 0 483844 | 1 936222 | 0 500740 | 2 |
| 3 | 2 910888 | 0 725766 | 2 904333 | 0 751110 | 3 |
| 4 | 3 881184 | 0 967688 | 3 872444 | 1 001480 | 4 |
| 5 | 4 851480 | 1 209610 | 4 840555 | 1 251850 | 5 |
| 6 | 5 821776 | 1 451532 | 5 808666 | 1 502220 | 6 |
| 7 | 6 792072 | 1 693454 | 6 776777 | 1 752590 | 7 |
| 8 | 7 762368 | 1 935376 | 7 744888 | 2 002960 | 8 |
| 9 | 8 732664 | 2 177298 | 8 712999 | 2 253330 | 9 |
| | 75° | 15° | 74° 30′ | 15° 30′ | |
| 1 | 0.965926 | 0.258819 | 0.963594 | 0.267228 | 1 |
| 2 | 1 931852 | 0 517638 | 1 927188 | 0 534456 | 2 |
| 3 | 2 897778 | 0 776457 | 2 890782 | 0 801684 | 3 |
| 4 | 3 863704 | 1 035276 | 3 854376 | 1 069112 | 4 |
| 5 | 4 829630 | 1 294095 | 4 817970 | 1 336540 | 5 |
| 6 | 5 795556 | 1 552914 | 5 781564 | 1 603578 | 6 |
| 7 | 6 761482 | 1 811733 | 6 775158 | 1 870896 | 7 |
| 8 | 7 727408 | 2 070552 | 7 748752 | 2 138224 | 8 |
| 9 | 8 703334 | 2 329371 | 8 712346 | 2 405452 | 9 |
| | 74° | 16 | 73° 30′ | 16° 30′ | |
| 1 | 0.961262 | 0.275637 | 0.958783 | 0.284004 | 1 |
| 2 | 1 922524 | 0 551274 | 1 917566 | 0 568008 | 2 |
| 3 | 2 883786 | 0 826911 | 2 876349 | 0 852012 | 3 |
| 4 | 3 845048 | 1 102548 | 3 835132 | 1 136016 | 4 |
| 5 | 4 806310 | 1 378185 | 4 793915 | 1 420020 | 5 |
| 6 | 5 767572 | 1 653822 | 5 752698 | 1 704024 | 6 |
| 7 | 6 724834 | 1 929459 | 6 711481 | 1 988028 | 7 |
| 8 | 7 690096 | 2 205096 | 7 670264 | 2 272032 | 8 |
| 9 | 8 651358 | 2 480733 | 8 629047 | 2 556036 | 9 |

| Dist. | Latitude. 73° | Departure. 17 | Latitude. 72 30′ | Departure. 17° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.956305 | 0.292372 | 0.953681 | 0.300694 | 1 |
| 2 | 1 912610 | 0 584744 | 1 907362 | 0 601388 | 2 |
| 3 | 2 868915 | 0 877116 | 2 861043 | 0 902082 | 3 |
| 4 | 3 825220 | 1 169488 | 3 814724 | 1 202776 | 4 |
| 5 | 4 781525 | 1 461860 | 4 768405 | 1 503470 | 5 |
| 6 | 5 737830 | 1 754232 | 5 722086 | 1 804164 | 6 |
| 7 | 6 693135 | 2 046604 | 6 675767 | 2 104858 | 7 |
| 8 | 7 650440 | 2 338976 | 7 629448 | 2 405552 | 8 |
| 9 | 8 606745 | 2 631348 | 8 583129 | 2 706246 | 9 |
| | 72° | 18° | 71° 30′ | 18° 30′ | |
| 1 | 0.951057 | 0.309017 | 0.948288 | 0.317292 | 1 |
| 2 | 1 902114 | 0 618034 | 1 896576 | 0 634584 | 2 |
| 3 | 2 853171 | 0 927051 | 2 834864 | 0 951876 | 3 |
| 4 | 3 804228 | 1 236068 | 3 793152 | 1 269168 | 4 |
| 5 | 4 755285 | 1 545085 | 4 741440 | 1 586460 | 5 |
| 6 | 5 706342 | 1 854102 | 5 689728 | 1 903752 | 6 |
| 7 | 6 657399 | 2 163119 | 6 638016 | 2 221044 | 7 |
| 8 | 7 608456 | 2 472136 | 7 586304 | 2 538328 | 8 |
| 9 | 8 559513 | 2 781153 | 8 534592 | 2 855628 | 9 |
| | 71° | 19° | 70° 30′ | 19° 30′ | |
| 1 | 0.945519 | 0.325568 | 0.942606 | 0.333794 | 1 |
| 2 | 1 891038 | 0 651136 | 1 885212 | 0 667588 | 2 |
| 3 | 2 836557 | 0 976704 | 2 827818 | 1 001382 | 3 |
| 4 | 3 782076 | 1 302272 | 3 770424 | 1 335176 | 4 |
| 5 | 4 727595 | 1 627840 | 4 713030 | 1 668970 | 5 |
| 6 | 5 673114 | 1 953408 | 5 655636 | 2 002764 | 6 |
| 7 | 6 618733 | 2 278976 | 6 598242 | 2 336558 | 7 |
| 8 | 7 564142 | 2 604544 | 7 540848 | 2 670352 | 8 |
| 9 | 8 509671 | 2 930212 | 8 483454 | 3 004116 | 9 |
| | 70° | 20° | 69° 30′ | 20° 30′ | |
| 1 | 0.939693 | 0.342020 | 0.936636 | 0.350194 | 1 |
| 2 | 1 879386 | 0 684040 | 1 873272 | 0 700388 | 2 |
| 3 | 2 819079 | 1 026060 | 2 809908 | 1 050582 | 3 |
| 4 | 3 758772 | 1 368080 | 3 747544 | 1 400776 | 4 |
| 5 | 4 698465 | 1 710100 | 4 683180 | 1 750970 | 5 |
| 6 | 5 638158 | 2 052120 | 5 619816 | 2 100164 | 6 |
| 7 | 6 577851 | 2 394140 | 6 557452 | 2 451358 | 7 |
| 8 | 7 517544 | 2 738160 | 7 495088 | 2 801552 | 8 |
| 9 | 8 457237 | 3 078180 | 8 430724 | 3 151746 | 9 |

| Dist. | Latitude. 69° | Departure. 21° | Latitude. 68° 30′ | Departure. 21°.30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.933580 | 0.358368 | 0 930382 | 0.366487 | 1 |
| 2 | 1 867160 | 0 716736 | 1 860764 | 0 732974 | 2 |
| 3 | 2 800740 | 1 075104 | 2 791146 | 1 099461 | 3 |
| 4 | 3 734320 | 1 433572 | 3 721528 | 1 465948 | 4 |
| 5 | 4 667900 | 1 791840 | 4 651910 | 1 832435 | 5 |
| 6 | 5 601480 | 2 150208 | 5 582292 | 2 198922 | 6 |
| 7 | 6 535060 | 2 508676 | 6 512674 | 2 565409 | 7 |
| 8 | 7 468640 | 2 867144 | 7 443056 | 2 931896 | 8 |
| 9 | 8 402220 | 3 225412 | 8 373438 | 3 298383 | 9 |
| | 68° | 22° | 67° 30′ | 22° 30′ | |
| 1 | 0.927184 | 0.374607 | 0.923844 | 0.382069 | 1 |
| 2 | 1 854368 | 0 749214 | 1 847688 | 0 765338 | 2 |
| 3 | 2 781552 | 1 123821 | 2 771532 | 1 148007 | 3 |
| 4 | 3 708736 | 1 498428 | 3 695376 | 1 530676 | 4 |
| 5 | 4 635920 | 1 873035 | 4 621220 | 1 912445 | 5 |
| 6 | 5 563104 | 2 247614 | 5 543064 | 2 296014 | 6 |
| 7 | 6 490288 | 2 622249 | 6 466908 | 2 678683 | 7 |
| 8 | 7 417472 | 2 997856 | 7 390752 | 3 061352 | 8 |
| 9 | 8 344656 | 3 371463 | 8 316596 | 3 444121 | 9 |
| | 67° | 23° | 66° 30′ | 23° 30′ | |
| 1 | 0.920505 | 0.390731 | 0.917025 | 0.398734 | 1 |
| 2 | 1 841010 | 0 781162 | 1 834050 | 0 797468 | 2 |
| 3 | 2 761515 | 1 172193 | 2 751075 | 1 196202 | 3 |
| 4 | 3 682020 | 1 562924 | 3 668100 | 1 594936 | 4 |
| 5 | 4 602725 | 1 953655 | 4 585125 | 1 993670 | 5 |
| 6 | 5 523030 | 2 344386 | 5 502150 | 2 392404 | 6 |
| 7 | 6 442535 | 2 735117 | 6 419175 | 2 792138 | 7 |
| 8 | 7 364040 | 3 125948 | 7 336200 | 3 189872 | 8 |
| 9 | 8 284745 | 3 516579 | 8 253225 | 3 589606 | 9 |
| | 66° | 24° | 65° 30′ | 24° 30′ | |
| 1 | 0.913545 | 0.406737 | 0.909926 | 0.414677 | 1 |
| 2 | 1 827090 | 0 813474 | 1 819852 | 0 829354 | 2 |
| 3 | 2 740635 | 1 220211 | 2 729778 | 1 244031 | 3 |
| 4 | 3 654180 | 1 626948 | 3 639704 | 1 658708 | 4 |
| 5 | 4 567725 | 2 033685 | 4 549630 | 2 073385 | 5 |
| 6 | 5 481370 | 2 440422 | 5 459556 | 2 488062 | 6 |
| 7 | 6 394815 | 2 847179 | 6 369482 | 2 803739 | 7 |
| 8 | 7 308360 | 3 253896 | 7 279408 | 3 317416 | 8 |
| 9 | 8 221905 | 3 660633 | 8 189324 | 3 732093 | 9 |

| Dist. | Latitude. 65° | Departure. 25° | Latitude. 64° 30′ | Departure. 25 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.906308 | 0.422618 | 0.902551 | 0 430494 | 1 |
| 2 | 1 812616 | 0 845236 | 1 805102 | 0 860988 | 2 |
| 3 | 2 718924 | 1 267854 | 2 707653 | 1 291482 | 3 |
| 4 | 3 625232 | 1 690472 | 3 610204 | 1 721976 | 4 |
| 5 | 4 531540 | 2 113090 | 4 512755 | 2 152470 | 5 |
| 6 | 5 437848 | 2 535708 | 5 415306 | 2 582964 | 6 |
| 7 | 6 344156 | 2 958316 | 6 317857 | 3 014458 | 7 |
| 8 | 7 250464 | 3 380924 | 7 220408 | 3 443952 | 8 |
| 9 | 8 156772 | 3 803562 | 8 122959 | 3 874446 | 9 |
| | 64° | 26° | 63° 30′ | 26 30′ | |
| 1 | 0.898798 | 0.438371 | 0.894901 | 0.446181 | 1 |
| 2 | 1 797596 | 0 876742 | 1 789802 | 0 892362 | 2 |
| 3 | 2 696394 | 1 315113 | 2 684703 | 1 338543 | 3 |
| 4 | 3 595192 | 1 753484 | 3 579604 | 1 784724 | 4 |
| 5 | 4 493990 | 2 191855 | 4 474505 | 2 230905 | 5 |
| 6 | 5 392788 | 2 630226 | 5 369406 | 2 677086 | 6 |
| 7 | 6 291586 | 3 068597 | 6 264307 | 3 123267 | 7 |
| 8 | 7 190384 | 3 506968 | 7 159208 | 3 569448 | 8 |
| 9 | 8 088182 | 3 945339 | 8 044109 | 4 015629 | 9 |
| | 6 3° | 27° | 62° 30′ | 27 30′ | |
| 1 | 0.891007 | 0.453990 | 0.886977 | 0.461731 | 1 |
| 2 | 1 782014 | 0 907980 | 1 773954 | 0 923463 | 2 |
| 3 | 2 673021 | 1 361970 | 2 660931 | 1 385193 | 3 |
| 4 | 3 564028 | 1 815960 | 3 547908 | 2 846924 | 4 |
| 5 | 4 455035 | 2 269950 | 4 434885 | 2 308655 | 5 |
| 6 | 5 346042 | 2 723940 | 5 321862 | 2 770386 | 6 |
| 7 | 6 237049 | 3 177930 | 6 208832 | 3 232117 | 7 |
| 8 | 7 128056 | 3 631920 | 7 095816 | 3 693848 | 8 |
| 9 | 8 019063 | 4 085910 | 7 982793 | 4 155589 | 9 |
| | 62° | 28° | 61° 30′ | 28 30′ | |
| 1 | 0.882946 | 0.469472 | 0.878784 | 0.477141 | 1 |
| 2 | 1 765896 | 0 938944 | 1 757568 | 0 954282 | 2 |
| 3 | 2 648844 | 1 408416 | 2 636352 | 1 431423 | 3 |
| 4 | 3 531792 | 1 877888 | 3 515136 | 1 908564 | 4 |
| 5 | 4 424740 | 2 347360 | 4 393920 | 2 385705 | 5 |
| 6 | 5 297688 | 2 816832 | 5 272704 | 2 862846 | 6 |
| 7 | 6 180636 | 3 286304 | 6 151486 | 3 339987 | 7 |
| 8 | 7 063544 | 3 755776 | 7 030272 | 3 817133 | 8 |
| 9 | 7 946532 | 4 225248 | 7 909056 | 4 294269 | 9 |

| Dist. | Latitude. 61° | Departure. 29° | Latitude. 60° 30′ | Departure. 29° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.874620 | 0.484810 | 0.870322 | 0.492405 | 1 |
| 2 | 1 749240 | 0 969620 | 1 740644 | 0 984810 | 2 |
| 3 | 2 623860 | 1 454430 | 2 610966 | 1 477215 | 3 |
| 4 | 3 498480 | 1 939240 | 3 481288 | 1 969620 | 4 |
| 5 | 4 373100 | 2 424050 | 4 351610 | 2 462025 | 5 |
| 6 | 5 247720 | 2 908860 | 5 221932 | 2 954430 | 6 |
| 7 | 6 122340 | 3 393670 | 6 092254 | 3 446835 | 7 |
| 8 | 6 996960 | 3 878480 | 6 972576 | 3 939240 | 8 |
| 9 | 7 871580 | 4 363290 | 7 832898 | 4 431645 | 9 |
| | 60° | 30° | 59° 30′ | 30° 30′ | |
| 1 | 0.866025 | 0.500000 | 0.861596 | 0.507519 | 1 |
| 2 | 1 732050 | 1 000000 | 1 723192 | 1 015038 | 2 |
| 3 | 2 598075 | 1 500000 | 2 584788 | 1 522557 | 3 |
| 4 | 3 464100 | 2 000000 | 3 446384 | 2 030076 | 4 |
| 5 | 4 330125 | 2 500000 | 4 327980 | 2 537595 | 5 |
| 6 | 5 198150 | 3 000000 | 5 169576 | 3 045114 | 6 |
| 7 | 6 062175 | 3 500000 | 6 031172 | 3 552633 | 7 |
| 8 | 6 928200 | 4 000000 | 6 892768 | 4 060152 | 8 |
| 9 | 7 794225 | 4 500000 | 7 754364 | 4 567671 | 9 |
| | 59° | 31° | 58° 30′ | 31° 30′ | |
| 1 | 0.857167 | 0.515038 | 0.852607 | 0.522478 | 1 |
| 2 | 1 714334 | 1 030076 | 1 705214 | 1 044956 | 2 |
| 3 | 2 571501 | 1 556114 | 2 557821 | 1 567434 | 3 |
| 4 | 3 428668 | 2 060152 | 3 410428 | 2 089912 | 4 |
| 5 | 4 285835 | 2 515190 | 4 263035 | 2 612390 | 5 |
| 6 | 5 143002 | 3 090228 | 5 115642 | 3 134868 | 6 |
| 7 | 6 000169 | 3 603266 | 5 968249 | 3 657346 | 7 |
| 8 | 6 857336 | 4 120304 | 6 820856 | 4 179824 | 8 |
| 9 | 7 714503 | 4 635342 | 7 673463 | 4 702302 | 9 |
| | 58° | 32° | 57° 30′ | 32° 30′ | |
| 1 | 0.848048 | 0.529919 | 0.843359 | 0.537279 | 1 |
| 2 | 1 696096 | 1 059838 | 1 686718 | 1 074558 | 2 |
| 3 | 2 544144 | 1 589757 | 2 530077 | 1 612837 | 3 |
| 4 | 3 392192 | 2 119676 | 3 373436 | 2 149116 | 4 |
| 5 | 4 240240 | 2 649595 | 4 216795 | 2 687395 | 5 |
| 6 | 5 088288 | 3 179514 | 5 060154 | 3 225674 | 6 |
| 7 | 5 936336 | 3 709433 | 5 903513 | 3 761953 | 7 |
| 8 | 6 784384 | 4 239352 | 6 746872 | 4 298232 | 8 |
| 9 | 7 632432 | 4 769271 | 7 590231 | 4 83[illegible] | 9 |

| Dist. | Latitude. 57° | Departure. 33° | Latitude. 56° 30′ | Departure. 33° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.838671 | 0.544639 | 0.833851 | 0.551916 | 1 |
| 2 | 1 677342 | 1 089278 | 1 667708 | 1 103832 | 2 |
| 3 | 2 516013 | 1 633917 | 2 001562 | 1 655748 | 3 |
| 4 | 3 354684 | 2 178556 | 3 335416 | 2 207664 | 4 |
| 5 | 4 193355 | 2 723195 | 4 169270 | 2 759580 | 5 |
| 6 | 5 032026 | 3 267834 | 5 003124 | 3 311496 | 6 |
| 7 | 5 870697 | 3 812473 | 5 836978 | 3 863412 | 7 |
| 8 | 6 709368 | 4 357112 | 6 670832 | 4 415328 | 8 |
| 9 | 7 548039 | 4 901751 | 7 504686 | 4 967244 | 9 |
| | 56° | 34° | 55° 30′ | 34° 30′ | |
| 1 | 0.829038 | 0.559193 | 0.824145 | 0.566384 | 1 |
| 2 | 1 658076 | 1 118386 | 1 648290 | 1 132768 | 2 |
| 3 | 2 587114 | 1 677579 | 2 472435 | 1 699152 | 3 |
| 4 | 3 316152 | 2 236772 | 3 296580 | 2 265536 | 4 |
| 5 | 4 145190 | 2 795965 | 4 120725 | 2 831920 | 5 |
| 6 | 5 974228 | 3 355158 | 4 944870 | 3 398304 | 6 |
| 7 | 5 803266 | 3 914351 | 5 769015 | 3 964688 | 7 |
| 8 | 6 632304 | 4 473544 | 6 593160 | 4 531072 | 8 |
| 9 | 7 461342 | 5 032737 | 7 417305 | 5 097456 | 9 |
| | 55° | 35° | 54° 30′ | 35° 30′ | |
| 1 | 0.819152 | 0.573576 | 0.814084 | 0.580630 | 1 |
| 2 | 1 638304 | 1 147152 | 1 628168 | 1 161260 | 2 |
| 3 | 2 457456 | 1 720728 | 2 442252 | 1 741890 | 3 |
| 4 | 3 276608 | 2 294304 | 3 256336 | 2 322520 | 4 |
| 5 | 4 095760 | 2 867980 | 4 070420 | 2 903150 | 5 |
| 6 | 4 914912 | 3 441456 | 4 884504 | 3 483780 | 6 |
| 7 | 5 734064 | 4 015032 | 5 698588 | 4 064410 | 7 |
| 8 | 6 553216 | 4 588608 | 6 512672 | 4 645040 | 8 |
| 9 | 7 372368 | 5 162084 | 7 326756 | 5 225670 | 9 |
| | 54° | 36° | 53° 30′ | 36° 30′ | |
| 1 | 0.809017 | 0.587785 | 0.803826 | 0.594800 | 1 |
| 2 | 1 618034 | 1 175570 | 1 607652 | 1 189600 | 2 |
| 3 | 2 427051 | 1 763355 | 2 411478 | 1 784400 | 3 |
| 4 | 3 236068 | 2 351140 | 3 215304 | 2 379200 | 4 |
| 5 | 4 045085 | 2 938925 | 4 019130 | 2 974000 | 5 |
| 6 | 4 854102 | 3 526710 | 4 822956 | 3 568800 | 6 |
| 7 | 5 663119 | 4 114495 | 5 626782 | 4 163600 | 7 |
| 8 | 6 472136 | 4 702280 | 6 430608 | 4 758400 | 8 |
| 9 | 7 281153 | 5 290065 | 7 234434 | 5 353200 | 9 |

| Dist. | Latitude. 53° | Departure. 37° | Latitude. 52° 30′ | Departure. 37° 30′ | Dist. |
|---|---|---|---|---|---|
| 1 | 0.798636 | 0.601815 | 0.793323 | 0.608736 | 1 |
| 2 | 1 597272 | 1 203630 | 1 586646 | 1 217476 | 2 |
| 3 | 2 395908 | 1 805445 | 2 379969 | 1 826214 | 3 |
| 4 | 3 194344 | 2 407260 | 3 173292 | 2 434952 | 4 |
| 5 | 3 993180 | 3 009075 | 3 966615 | 3 043690 | 5 |
| 6 | 4 791816 | 3 610890 | 4 759938 | 3 652428 | 6 |
| 7 | 5 590252 | 4 212705 | 5 553261 | 4 261166 | 7 |
| 8 | 6 388688 | 4 814580 | 6 346584 | 4 869904 | 8 |
| 9 | 7 187524 | 5 416335 | 7 139907 | 5 478642 | 9 |
| | 52° | 38° | 51° 30′ | 38° 30′ | |
| 1 | 0.788011 | 0.615661 | 0.782578 | 0.622490 | 1 |
| 2 | 1 576022 | 1 231322 | 1 565156 | 1 244980 | 2 |
| 3 | 2 364033 | 1 846983 | 2 347734 | 1 867470 | 3 |
| 4 | 3 152044 | 2 462644 | 3 130312 | 2 489960 | 4 |
| 5 | 3 940055 | 3 078305 | 3 912890 | 3 112450 | 5 |
| 6 | 4 728066 | 3 693966 | 4 695468 | 3 734940 | 6 |
| 7 | 5 516077 | 4 309627 | 5 478046 | 4 357430 | 7 |
| 8 | 6 304088 | 4 925288 | 6 260624 | 4 979920 | 8 |
| 9 | 7 092099 | 5 540949 | 7 043202 | 5 602410 | 9 |
| | 51° | 39° | 50° 30′ | 39° 30′ | |
| 1 | 0.777146 | 0.629320 | 0.771595 | 0.636054 | 1 |
| 2 | 1 554292 | 1 258640 | 1 543190 | 1 272108 | 2 |
| 3 | 2 331438 | 1 887960 | 2 314785 | 1 908162 | 3 |
| 4 | 3 108584 | 2 517280 | 3 086380 | 2 544216 | 4 |
| 5 | 3 885730 | 3 146600 | 3 857975 | 3 180270 | 5 |
| 6 | 4 662876 | 3 775920 | 4 629570 | 3 816324 | 6 |
| 7 | 5 440022 | 4 205240 | 5 401165 | 4 452378 | 7 |
| 8 | 6 217168 | 5 034560 | 6 172760 | 5 088432 | 8 |
| 9 | 6 994314 | 5 663880 | 6 944355 | 5 724486 | 9 |
| | 50°. | 40° | 49° 30′ | 40° 30′ | |
| 1 | 0.766044 | 0.642788 | 0.760377 | 0.649423 | 1 |
| 2 | 1 532088 | 1 285576 | 1 520754 | 1 298846 | 2 |
| 3 | 2 298132 | 1 928364 | 2 281131 | 1 948269 | 3 |
| 3 | 3 064176 | 2 571152 | 3 041508 | 2 597692 | 4 |
| 5 | 3 830220 | 3 213940 | 3 801885 | 3 247115 | 5 |
| 6 | 4 596264 | 3 856728 | 4 562262 | 3 896538 | 6 |
| 7 | 5 362308 | 4 499516 | 5 322639 | 4 545961 | 7 |
| 8 | 6 128252 | 5 142304 | 6 083016 | 5 195384 | 8 |
| 9 | 6 894396 | 5 785092 | 6 843393 | 5 844807 | 9 |

| Dist. | Lat 40° | Dep. 41° | Lat. 41° 30′ | Dep. 41° 30′ | Lat. 45° | Dist. |
|---|---|---|---|---|---|---|
| 1 | 0.754710 | 0.656059 | 0.748927 | 0 661595 | 0.707107 | 1 |
| 2 | 1 509420 | 1 312118 | 1 497854 | 1 323190 | 1 414214 | 2 |
| 3 | 2 264130 | 1 968177 | 2 246781 | 1 984785 | 2 121321 | 3 |
| 4 | 3 018840 | 2 624236 | 2 995708 | 2 646380 | 2 828428 | 4 |
| 5 | 3 773550 | 3 280295 | 3 744635 | 3 307975 | 3 535535 | 5 |
| 6 | 4 528260 | 3 936354 | 4 493562 | 3 969570 | 4 242642 | 6 |
| 7 | 5 282970 | 4 592413 | 5 242489 | 4 638165 | 4 949749 | 7 |
| 8 | 6 037680 | 5 248472 | 5 991416 | 5 300760 | 5 656856 | 8 |
| 9 | 6 792390 | 5 904531 | 6 740342 | 5 963355 | 6 363963 | 9 |
| | 48° | 42° | 47° 30′ | 42° 30′ | | |
| 1 | 0.743145 | 0.669131 | 0.737249 | 0.675564 | | 1 |
| 2 | 1 486290 | 1 338262 | 1 474498 | 1.351128 | | 2 |
| 3 | 2 229435 | 2 007393 | 2 211747 | 2 026692 | | 3 |
| 4 | 2 972580 | 2 676524 | 2 948996 | 2 702256 | | 4 |
| 5 | 3 715725 | 3 346655 | 3 686245 | 3 379920 | | 5 |
| 6 | 4 458870 | 4 011786 | 4 423494 | 4 053884 | | 6 |
| 7 | 5 202015 | 4 683817 | 5 160743 | 4 718948 | | 7 |
| 8 | 5 945160 | 5 353048 | 5 897992 | 5 404512 | | 8 |
| 9 | 6 688205 | 6 023179 | 6 634241 | 6 090076 | | 9 |
| | 47° | 43° | 46° 30′ | 43° 30′ | | |
| 1 | 0.731354 | 0.681928 | 0.725347 | 0.688326 | | 1 |
| 2 | 1 462708 | 1 363096 | 1 450794 | 1 376656 | | 2 |
| 3 | 2 194062 | 2 045094 | 2 176041 | 2 064984 | | 3 |
| 4 | 2 925416 | 2 727992 | 2 901388 | 2 753312 | | 4 |
| 5 | 3 656770 | 3 409930 | 3 626735 | 3 441640 | | 5 |
| 6 | 4 388124 | 4 091988 | 4 352082 | 4 129968 | | 6 |
| 7 | 5 119478 | 4 773986 | 5 077429 | 4 818296 | | 7 |
| 8 | 5 850832 | 5 455984 | 5 802776 | 5 506624 | | 8 |
| 9 | 6 582186 | 6 137982 | 6 528123 | 6 194952 | | 9 |
| | 46° | 44° | 45° 30′ | 44° 30′ | Lat. 88° | |
| 1 | 0.719340 | 0.694658 | 0.713223 | 0,700882 | 0.999391 | 1 |
| 2 | 1 438680 | 1 389316 | 1 426446 | 1 401764 | 1.998782 | 2 |
| 3 | 2 158020 | 2 083974 | 2 139669 | 2 102646 | 2 998173 | 3 |
| 4 | 2 877360 | 2 778632 | 2 852892 | 2 803528 | 3 997564 | 4 |
| 5 | 3 596700 | 3 473290 | 3 566115 | 3 504410 | 4 996955 | 5 |
| 6 | 4 316040 | 4 167948 | 4 279338 | 4 205292 | 5 996346 | 6 |
| 7 | 5 035380 | 4 862606 | 4 992561 | 4 906174 | 6 995737 | 7 |
| 8 | 5 754720 | 5 557264 | 5 705784 | 5 607056 | 7 995128 | 8 |
| 9 | 6 474060 | 6 251922 | 6 419007 | 6 307938 | 8 994519 | 9 |

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ERRATA. The 61 and 62 pages, should have been in the place of the 66 and 67 pages, or between the tables of square timber and round timber.—The line at the bottom of the 87 page should be at the top.—In the Traverse table, page 103, under 88 degrees Latitude, is wrong, and it will be found corrected, under Latitude 45 degrees, page 118.

CAV. H.